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STATE OF NEVADA

SEVENTH BIENNIAL REPORT

OF THE

DEPARTMENT OF HIGHWAYS

1929=1930

CARSON CITY, NEVADA
STATE PRINTING OFFICE - - JOE FARNSWORTH, SUPERINTENDENT
1931

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PERSONNEL OF THE DEPARTMENT OF HIGHWAYS

ADMINISTRATION

F. B. Balzar ..... Chairman Board of Directors
E. C. Peterson ..... Director
M. A. Diskin ..... Director
S. C. Durkee ..... State Highway Engineer
W. A. Young ..... Assistant State Highway Engineer
H. D. Mills ..... Office Engineer and Secretary to Board of Directors
E. C. Pohl ..... Chief Accountant

DEPARTMENTS

W. T. Holcomb ..... Chief Draftsman
George R. Egan ..... Bridge Engineer
Frank Morrison ..... Testing Engineer
J. P. Rawson ..... Equipment Superintendent
Dale B. Pruett ..... Right of Way Engineer
D. B. Renear ..... Inspector, Nevada State Police

DIVISIONS

C. C. Boyer ..... Division Engineer, Division No. 1
Art Loforth ..... Division Engineer, Division No. 2
Waite Bruce ..... Division Engineer, Division No. 3
Frank H. Depp ..... Division Engineer, Division No. 4
J. C. Rodder ..... Division Engineer, Division No. 5

LETTER OF TRANSMITTAL

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CARSON CITY, January 1, 1931.

HONORABLE F. B. BALZAR, *Governor of the State of Nevada.*

DEAR SIR: We take pleasure in presenting the seventh biennial report of the Department of Highways, covering the fiscal years 1929–1930, beginning December 1, 1928, and ending November 30, 1930.

It is the intent of this report to briefly set forth the activities and accomplishments of the Department during the last biennial period, and outline a tentative program for the forthcoming two years.

Through this report we desire to express an appreciation to the officials of the United States Bureau of Public Roads and Federal Forest Service for their valued assistance; to the County Commissioners for their helpful cooperation; to the employees of the Department for their loyalty and industrious service; and to yourself and all members of your administration for your support and approval which have in no small measure been beneficial in conducting the business of this Department.

Respectfully,
BOARD OF HIGHWAY DIRECTORS,
By S. C. DURKEE, *State Highway Engineer.*

VIEW OF MT. WHEELER, HIGHEST MOUNTAIN IN NEVADA, FROM CONNOR'S PASS, WHITE PINE COUNTY.

INTRODUCTION TO SEVENTH BIENNIAL REPORT

HEROES MEMORIAL BUILDING
Highway Department Headquarters, Carson City, Nevada.

INTRODUCTION TO SEVENTH BIENNIAL REPORT

Nevada, with its large area of unappropriated land, small population, and limited resources depends largely upon Federal funds for highway improvements. Inasmuch as the Federal Government participates to the extent of 88.85% in the actual costs of construction and reconstruction of Federal aid road mileage within the State, the development and improvement of the State Highway System, and especially that portion approved by the Secretary of Agriculture as the seven per cent system, are Federal and State problems and cannot be treated as local issues. The rules and regulations governing expenditure of Federal funds appropriated for highway purposes are clear-cut and definitely define the State's obligation in carrying out the provisions of the Federal Aid Road Act.

Probably at no time during the history of the Department of Highways has there been as much State-wide enthusiasm for road improvements as there has been during the past two years. This condition is due somewhat to the increasing number of road users and to the popularity of the new oil treated surfaced roads the Department has built during the biennium.

Public demand for new and higher type road improvements has far exceeded the income for highway purposes. For this reason every dollar available to the State Highway Fund must be spent for improvements and maintenance that will be beneficial to the general transportation scheme of the State.

It is easily understood that good roads are creating more business and more wealth, and therefore are a vital necessity to the development of every community in the State, but unfortunately the people who demand the most in the way of highway improvements do not or will not understand that with the present financial resources it is economically impossible for the State to make any extensive improvements other than those that will expedite completion of the Federal Aid System

There is no doubt that in the near future when the present designated Federal aid road mileage has been improved to the satisfaction of the Secretary of Agriculture, additional Federal aid mileage will be authorized, and that this mileage will provide for improving the various connecting roads and other extensions to the State Highway System which the public is now demanding.

When the Department of Highways was established, and the State first attempted to make provisions for financing highway improvements, the undertaking met with disfavor on all sides and every possible effort was made to discourage the plan. Despite the fact that early developments were handicapped by numerous obstacles and engineering difficulties, Nevada has achieved outstanding results in highway improvement with a comparatively small expenditure of State funds. These results have gradually changed public opinion so that today the public is in favor of extending highway improvements faster than the State's resources will permit. The need for extending highway operations is justified by the tremendous increase in the

VICTORY HIGHWAY LOOKING EAST FROM CALIFORNIA-NEVADA STATE LINE.

number of motor vehicles using the roads; however, the amount of money the State can afford to spend for expansion must be taken into consideration as well as the benefits the road users would receive. There is no sound argument to advance against further expansion and improvement of the State Highway System, providing some other means of raising revenue to meet the costs can be developed without levying too heavy a tax burden upon the general public.

In Nevada there are thousands of miles of road that never can be improved for general use with State and Federal funds, and it will be several years before the Federal Aid System will be completed to the point where it can economically sustain a heavy traffic load. Therefore, in determining policies to govern future improvements the Department cannot overemphasize the importance of confining highway activities so that future maintenance will not become a liability on the road user or to the taxable property in the State.

All the foregoing is largely introductory to presenting a review of the underlying purpose of the "Gasoline Tax Law" and the importance of retaining the income in the State Highway Fund for maintenance purposes.

GASOLINE TAXATION FOR STATE HIGHWAY PURPOSES

The system of raising revenue for highway construction and maintenance by means of imposing a tax on gasoline used in automotive vehicles is now an established and accepted principle. On January 1, 1930, every State in the Union, including the District of Columbia, was levying a tax on gasoline, varying from two to six cents and averaging a fraction less than four cents. The basic idea of gasoline taxation is to impose a special tax for the purpose of maintaining highways, and is justified on the ground that it is a license paid by the users of the highways to offset the damage done by motor vehicle traffic.

The Nevada Legislature of 1923 enacted what is commonly known as "The Gasoline Tax Law" which was approved March 20, 1923.

This Act provided for an excise tax of two cents a gallon on gasoline and other volatile and inflammable liquids, and designated that $60,000 of the annual income was to be apportioned to the State Highway Fund and the balance was to be divided among the various counties of the State according to the number of motor vehicles registered in each county.

During the years 1923, 1924 and until April 1, 1925, or during the effective period of the Act prior to the legislative amendment of 1925, the counties received a total of $167,680.42 as their share of the gasoline tax, the distribution being as shown in Table No. 1.

The 1925 Legislature amended the 1923 Act by increasing the tax on gasoline and other volatile and inflammable liquids from two to four cents a gallon, and apportioned the income, after the refunds had been provided for, as follows: 50 per cent to the State Highway Fund and 50 per cent to the counties, prorated in the same manner as set forth in the Act of 1923. Under the amended Act of 1925 the counties' share of the gasoline tax was placed in the County-State Highway Fund instead of the road fund of the counties, and could only be spent for construction on the State Highway System within

TABLE NO. 1

Distribution of the Gasoline Tax Revenue for the Years 1923, 1924 and until March 31, 1925

Counties	1923	Per cent	1924	Per cent	Jan. 1 to March 31, 1925	Per cent
Churchill	$3,203.69	7.12	$6,513.82	6.89	$1,940.87	6.89
Clark	3,280.19	7.29	7,769.55	8.22	2,315.53	8.22
Douglas	1,511.86	3.36	2,691.58	2.85	802.83	2.85
Elko	3,829.12	8.51	8,514.99	9.01	2,538.06	9.01
Esmeralda	989.90	2.20	1,781.04	1.88	529.58	1.88
Eureka	620.93	1.38	1,340.79	1.42	400.01	1.42
Humboldt	2,020.30	4.49	4,332.54	4.58	1,290.16	4.58
Lander	1,160.89	2.58	2,331.36	2.47	695.78	2.47
Lincoln	836.91	1.86	1,791.05	1.90	535.22	1.90
Lyon	2,618.74	5.82	4,982.92	5.27	1,484.53	5.27
Mineral	602.95	1.34	1,435.84	1.52	428.17	1.52
Nye	3,172.20	7.05	5,693.34	6.02	1,695.80	6.02
Ormsby	1,210.39	2.69	3,151.85	3.34	940.86	3.34
Pershing	1,381.37	3.07	2,781.63	2.94	828.18	2.94
Storey	949.40	2.11	1,690.99	1.79	504.23	1.79
Washoe	14,286.11	31.75	29,642.36	31.36	8,833.93	31.36
White Pine	3,320.68	7.38	8,069.73	8.54	2,405.67	8.54
Totals	$44,995.63	100.00	$94,515.38	100.00	$28,169.41	100.00
State	60,000.00		60,000.00		15,000.00	
Refund to individuals	5,085.72		8,081.05		1,661.49	
	$110,081.35		$162,596.43		$44,830.90	

TABLE NO. 2

Distribution of Gasoline Tax Revenue from April 1, 1925, to March 31, 1929

Counties	April 1 to Dec. 31 1925	Per cent	1926	Per cent	1927	Per cent	1928	Per cent	Jan. 1 to March 31, 1929	Per cent
Churchill	$10,244.78	6.95	$15,257.82	7.89	$13,880.16	6.20	$17,784.48	6.95	$8,462.02	6.82
Clark	11,572.70	7.85	13,224.90	6.84	17,386.38	7.76	20,996.48	8.20	10,601.95	8.55
Douglas	4,323.61	2.93	5,786.22	2.99	6,796.51	3.04	7,723.33	3.02	3,574.76	2.88
Elko	13,100.50	8.88	17,429.02	9.02	20,476.21	9.15	23,763.65	9.28	10,660.92	8.59
Esmeralda	2,853.00	1.93	4,006.11	2.07	4,205.90	1.88	4,353.58	1.70	2,146.23	1.73
Eureka	2,127.10	1.44	3,635.35	1.88	3,930.23	1.76	3,879.36	1.51	1,759.12	1.42
Humboldt	6,614.14	4.48	9,226.40	4.78	9,580.75	4.28	11,621.16	4.54	5,512.14	4.44
Lander	3,448.44	2.34	3,860.00	2.00	5,182.84	2.31	5,487.01	2.14	2,595.07	2.09
Lincoln	2,712.94	1.84	3,828.17	1.98	5,454.65	2.44	6,370.33	2.49	3,165.80	2.55
Lyon	7,842.86	5.32	10,882.22	5.63	12,564.74	5.61	13,577.22	5.30	7,908.40	6.38
Mineral	2,476.70	1.68	3,687.59	1.91	4,177.95	1.87	4,071.85	1.59	2,095.85	1.69
Nye	9,633.48	6.53	12,765.81	6.61	14,154.64	6.32	14,642.79	5.72	6,366.83	5.13
Ormsby	4,778.36	3.24	4,792.35	2.48	6,864.19	3.06	7,630.33	2.98	3,548.33	2.86
Pershing	4,335.62	2.94	5,915.62	3.06	6,641.97	2.96	8,437.51	3.30	4,214.61	3.40
Storey	2,679.12	1.82	3,617.20	1.87	2,834.20	1.27	2,073.76	0.81	885.89	0.72
Washoe	45,894.26	31.11	57,901.87	29.96	68,331.71	30.51	77,667.75	30.34	37,784.90	30.46
White Pine	12,857.39	8.72	17,449.35	9.03	21,463.30	9.58	25,921.30	10.13	12,764.37	10.29
Totals	$147,495.00	100.00	$193,266.00	100.00	$223,926.33	100.00	$256,001.89	100.00	$124,047.19	100.00
State	129,159.58		207,584.95		233,571.20		263,840.09		52,924.27	
Refund to individuals	14,062.39		27,898.29		38,401.69		43,882.90		8,371.00	
	$290,716.97		$428,749.24		$495,899.22		$563,724.88		$185,342.46	

Distribution to counties in 1929 is for last quarter of 1928 and first quarter of 1929.

each respective county and only under the direction of the State Highway Engineer.

In 1929 "The Gasoline Tax Law" was again amended by placing all of the money collected to the credit of the State Highway Fund and by also providing that sufficient money from the State Highway Fund be transferred on certain dates, as stated by several legislative Acts, to the counties for the interest and redemption of County-State highway bonds.

The gasoline tax was adopted by Nevada for a specific reason, and the sense of the law has always been maintained. When the Department first advocated the gasoline tax as a fair and equitable means of raising funds for State highway construction and maintenance, the proposal met with a great deal of opposition due to the lack of any acceptable information on the subject. Since the gasoline tax became

WILD CAT CANYON NEAR SITE OF BOULDER DAM.

a law very little complaint has been made against it; however, a proposition has been made to divert a part of the income for county road construction and maintenance. The proponents of this idea justify their argument on the fact that under the Act of 1923 the counties received $167,680.42 as their portion of the income from the gasoline tax; however, they have lost sight of the fact or have conveniently forgotten to mention that during the life of the Act, prior to its amendment in 1925, the counties participated to the extent of over a million dollars in the cost of construction of roads on the State Highway System.

If the gasoline tax income were apportioned 50 per cent to the State Highway Fund and 50 per cent to the counties it would be necessary to raise, by some other means, an amount equal to a 17 cent increase in the present State tax to replace the amount diverted. It is impossible for anyone familiar with the financial resources of the State

to conceive that the counties and State, or any individual, would benefit to any great extent by such a change.

The obligation which the State assumed in securing Federal aid funds for road construction makes it imperative that sufficient funds be provided by some means for maintenance of the Federal Aid Highway System satisfactory to the United States Bureau of Public Roads.

The Federal and State governments have a large investment in the Federal Aid Highway System which must be carefully maintained and protected. Due to the rapid growth of the highway system, and tremendous increase in motor vehicle travel and heavy transportation, the cost of maintaining and protecting the initial investment has grown to be one of the most perplexing problems with which the State has to deal. This problem is ever increasing and must be seriously and judiciously considered by the Legislature if the necessity should

COLORADO RIVER LOOKING DOWNSTREAM ON SITE OF BOULDER DAM.

arise to provide funds to replace the present income from the gasoline tax.

To achieve the greatest success and at the same time uphold the faith of the State in meeting its obligation with the Federal Government it is necessary for the Department of Highways to have an income that will increase annually in proportion to the increasing demands of the general public. The only source of revenue that is increasing nearly in proportion to highway expansion and motor vehicle transportation is the gasoline tax income.

From April 1, 1925, to April 1, 1929, one-half the money derived from the gasoline tax was placed in what was known as the County-State Highway Fund in accordance with the amended Act of 1925. None of this money was available for county road construction or maintenance, but was used to match Federal aid funds for State highway construction within the county. During the legislative

session of 1929 the United States Department of Agriculture notified the State that it would be necessary for the State to rearrange its State highway finances to meet the requirements and provisions of the Federal Aid Road Act, as the administration of the County-State Highway Fund did not conform with the provisions of the Act because the funds were not under direct control of the Department of Highways.

TABLE NO. 3

Distribution of Gasoline Tax Revenue from April 1, 1929, to December 31, 1930

	Apr. 1, to Dec. 31, 1929	*1930
State	$531,675.52	$675,000.00
Refund to individuals	51,834.78	75,000.00
Totals	$583,510.30	$750,000.00

*1930—Estimated.

After careful consideration of several alternatives, the Legislature wisely amended the "Gasoline Tax Law" and placed the entire income from the tax in the State Highway Fund. The requirement that caused this change is contained in section 7 of the Federal Aid Road Act and is as follows:

> That before any project shall be approved by the Secretary of Agriculture for any State such State shall make provisions for State funds required each year of such States by this Act for construction, reconstruction and maintenance of Federal aid highways within the State, which funds shall be under the direct control of the State Highway Departments.

Section 24 of the same Congressional Act reads as follows:

> That in any State where the existing constitution or laws will not permit the State to provide revenues for the construction, reconstruction and maintenance of highways, the Secretary of Agriculture shall continue to approve projects for said State until three years after the passage of this Act, if he shall find that said State has complied with the provisions of this Act in so far as its existing constitution and laws will permit.

From section 24 of the same Act it can be readily understood that Congress allowed the States three years in which to pass the necessary legislation for providing State funds under the control of the State Highway Departments for construction, reconstruction and maintenance of Federal aid highways.

Congressional amendments of 1925 and 1926 further extended the time when the States should pass appropriate legislation for direct control of funds to be used on Federal aid work.

The appropriation bill for Federal aid, passed by Congress on May 26, 1928, did not grant a further extension of time; therefore, on July 1, 1929, all States had to conform with the Federal Aid Road Act by having under legal control by the State Highway Department sufficient State funds to match Federal aid for highway construction.

Mr. F. N. Fletcher, in the *Nevada Tax Review,* has the following to say regarding State highway finances:

State Highway Finances

The Federal Government has been more than generous to Nevada in its appropriations for highway construction. It need not detract from our appreciation of this aid to know that it was not altogether spontaneous but was the result of hard work and constant diligence on the part of Senators Oddie and Pittman and Congressman Arentz. The result has been a highway program in this State that without such aid could hardly have been dreamed of. Time and again the Federal Highway Department has changed its rules and regulations to accommodate the Nevada department in order to overcome local conditions. On the other hand Nevada has played fair with the government and met its regulations so far as its limitations have allowed.

The Federal allotments to Nevada this year and for several years to come will allow the State to continue its road program but certain financial conditions will be required. Without going into details, the road program of the State for 1931 will require approximately one million dollars to maintain the State roads already built and to meet Federal funds for construction. This sum will be supplied, under present legislation, from the following sources:

From gasoline tax	$700,000
From automobile licenses	200,000
From state tax levy of 5 cents	106,000
Total	$1,006,000

The figures are estimates based on present information. The sum of $200,000 from licenses is the amount estimated as available after payment of interest and maturing bonds.

Up to 1929 the counties had shared the gasoline tax with the State. At that time the money derived from this source was placed in what was known as the County-State Highway Fund, and none of it was available for county road construction. During the legislative session the Federal department insisted, as was reasonable, that in matching Federal funds the State must have its funds in hand or legally provided for. The only way out at that time was either to allow the State to have all the proceeds of the gasoline tax or to levy a State highway tax amounting to the one-half going to the counties, which would have increased the tax levy for highway purposes from five to approximately twenty cents. The Legislature wisely apportioned the entire gasoline tax to the State.

A like condition will confront the next Legislature. Some of the counties were naturally disappointed at the loss of the gasoline tax, and it is reported that a strong effort will be made by them to secure one-half of the gasoline tax for county highways It is a matter of great importance which should, and no doubt will, receive very careful consideration by members of the Legislature.

Assuming that the State Highway Department is correct in

OFFICERS' QUARTERS AT NAVAL MUNITION DEPOT NEAR HAWTHORNE.

CONSTRUCTION IN PROGRESS AT NAVAL MUNITION DEPOT.

its estimates of money required to meet Federal funds for construction and for upkeep of roads already built, and these estimates will be available, the Legislature will be confronted with three alternatives: It may refuse to provide funds for the State department so that the work of construction and maintenance shall be reduced in order that county highway departments may have one-half of the gasoline tax; or it may levy an additional State highway tax of 17 cents to replace the revenues which this tax now provides; or it may leave the law as it is and let the counties do their own highway financing until the State highway construction program is completed, or until the Federal Government funds no longer require matching by State funds.

It is not at all probable that the Legislature will so reduce State highway revenues that the main highways now under construction and largely built by Federal funds will not be completed, or that those portions already finished will not be kept in repair. Such a procedure would be looked upon as short-sighted and would be strongly condemned by the general public. On the other hand it would be equally unpopular to increase the State tax levy for roads from five to twenty-two cents, which the second alternative would require. The third alternative, to leave the law as it is and give all the revenues from the gasoline tax to the State, seems the only practical course.

It is a mistaken notion to suppose that whatever money a county can get from the State is so much gain; in many cases it entails an actual loss. It would be so in many counties if the gasoline tax were divided with the counties and a State tax levied to take its place. As a matter of fact most of the gains to county funds would accrue to western counties while the losses would be largely in eastern and central counties. Washoe County, for example, would receive $106,750; while Elko would receive $33,950; but if the 17 cent additional tax were levied Washoe would raise $71,641, while Elko would raise $72,479. Washoe would have a net gain of $35,109, while Elko would have a net loss of $38,529.

The results of a division and a State levy are set forth for each county in the accompanying table. The figures for the number of cars owned in each county are reported from the Secretary of State's office as of September 23. Some changes will occur prior to December 31, but the percentages will not be much changed, if at all. The valuations are from the Tax Commission's compilation of tax rolls for 1930. Changes will be made in them through equalization, but not sufficient to invalidate the use here made of them. All the figures are based on estimates but they will be found to be substantially correct. It is assumed that the division of the gasoline tax, if made, would be on the basis of the number of cars licensed in each county.

Table showing results to counties of dividing the gasoline

tax revenues between the State and counties, and levying a State tax to replace it:

Counties	Cars licensed	Per cent of total	Revenue from gasoline tax	Assessed valuation	17 cent tax	Gain or loss
Churchill	1,799	6.4	$22,050	$9,316,615	$15,838	$6,212 gain
Clark	2,697	9.4	32,550	12,941,950	22,001	10,549 gain
Douglas	787	2.7	9,450	3,927,902	6,677	2,773 gain
Elko	2,758	9.8	33,950	42,635,174	72,479	38,529 loss
Esmeralda	442	1.5	5,250	3,059,942	5,201	49 gain
Eureka	393	1.4	4,900	7,229,314	12,289	7,389 loss
Humboldt	1,187	4.2	14,700	16,381,197	27,848	13,148 loss
Lander	593	2.1	7,350	6,549,096	11,133	3,783 loss
Lincoln	786	2.8	9,800	8,173,308	13,894	4,094 loss
Lyon	1,385	4.9	17,150	9,585,774	16,295	855 gain
Mineral	663	2.3	8,050	5,362,740	9,116	1,066 loss
Nye	1,293	4.7	16,100	5,923,616	10,070	6,030 gain
Ormsby	656	2.3	8,050	1,765,613	3,001	5,049 gain
Pershing	1,009	3.5	12,250	12,380,186	21,046	8,796 loss
Storey	195	.7	2,450	2,063,192	3,507	1,057 loss
Washoe	8,697	30.8	106,750	42,142,095	71,641	35,109 gain
White Pine	2,958	10.5	36,400	22,314,556	37,935	1,535 loss
Totals	28,280		$347,200	$211,752,270	$359,971	$12,771 loss

NATIONAL LEGISLATION

The systematic and rapid improvement of the highway system in Nevada has depended mainly upon the financial assistance of the Federal Government. Without this aid it would have been economically impossible for Nevada, with its limited resources, to have attempted a program of State highway improvements of any consequence. Very few changes have been made in Federal aid policies since the Federal Highway Law was enacted in 1921, under which the present appropriations are made.

The amounts allotted to Nevada each year under the provisions of the successive Federal legislative enactments have been as follows:

1917	$64,398.30
1918	128,796.60
1919	836,163.28
1920	1,221,573.57
1921	1,276,344.43
1922	953,436.78
1923	635,624.00
1924	826,410.00
1925	947,623.25
1926	956,576.00
1927	948,318.00
1928	948,510.00
1929	957,995.00
1930	960,375.00
1931	1,601,408.00
1932	1,598,987.00
Total	$14,862,539.21

The Federal Government has been generous in extending financial aid to the States for construction and reconstruction of highways on the seven per cent system, and this assistance has been appreciated. Federal allotment has been more or less regulated by apparent needs, and undoubtedly it will be the policy of the Federal Government to

favor the continuation of this aid until a road system, national in character, has been completed.

During the Federal Government's fiscal years 1925 to 1930, inclusive, Congress authorized an annual appropriation of $75,000,000 for the Federal aid program. On May 26, 1928, the 70th Congress authorized $75,000,000 for the fiscal year ending June 30, 1930, and $75,000,000 for the fiscal year ending June 30, 1931.

On April 4, 1930, the 71st Congress passed an amendment authorizing an increase of $50,000,000 in addition to the authorization for the fiscal year ending June 30, 1931, and the sum of $125,000,000 for the fiscal year ending June 30, 1932.

In order to anticipate the Federal funds available to the States for expanding and advancing their highway programs, the money authorized to be expended under the provisions of the Federal Highway Acts is apportioned to the States several months before the beginning of the Federal Government's fiscal year. This money may be placed under agreement by the States at any time during the six months prior to the beginning of the Federal fiscal year; however, any work done under this agreement must be financed by the State until the money actually becomes available for expenditure. Under this arrangement the State is reimbursed for the Federal Government's pro rata after the beginning of the Federal fiscal year.

Probably the most important National legislation affecting Nevada's future road building program was the passage by the 71st Congress of what is commonly known as the "Oddie-Colton Bill," which provides that the Federal Government shall assume the cost of building roads through public domain, including the survey, construction, reconstruction and maintenance of main roads through unappropriated public lands and Indian reservations, with no contributions from the States.

According to the original tentative schedule $3,500,000 annually was to have been apportioned among thirteen western States, described as those States having more than 5 per cent of their area in untaxable public lands. No appropriation has been made to date. However, it is expected that an appropriation will be approved by Congress in the near future for funds to carry out the provisions of the Oddie-Colton Bill.

THE ODDIE-COLTON BILL

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Federal Highway Act approved November 9, 1921 (Forty-second Statutes at Large, page 212), as amended or supplemented, be further amended by amending the second paragraph of section 3 of said Federal Highway Act to read as follows:

"The Secretary of Agriculture is authorized to cooperate with the State highway departments and with the Department of the Interior, in the survey, construction, reconstruction, and maintenance of main roads through unappropriated or unreserved public lands, nontaxable Indian lands, or other Federal reservations other than the forest reservations. Such sums as the Congress may hereafter authorize to be appropriated under the provisions of this section shall be apportioned among those States having more than 5 per centum of

PRODUCT OF NEVADA.

FOX FARM ADJACENT TO VICTORY HIGHWAY NEAR ELKO.

their area in the lands hereinbefore described and shall be prorated and apportioned to said States in the proportion that said lands in each of said States is to the total area of said lands in the States eligible under the provisions of this section, and no contribution from the States shall be required in the expenditure thereof; *provided*, that in the allocation of any such funds authorized to be appropriated under this section or any subsequent Act preference shall be given to those projects which are located on the Federal aid highway system as the same are now or may hereafter be designated.

"The Secretary of Agriculture shall prepare, publish and distribute a map and other information, at least annually, showing the progress made in the expenditures of the funds authorized under this section."

SEC. 2. All Acts or parts of Acts in any way inconsistent with the provisions of this Act are hereby repealed, and this Act shall take effect on its passage.

Approved June 24, 1930.

As the entire cost of improvement under the Oddie-Colton Bill extends only to roads that actually traverse unappropriated lands and Federal reservations, under jurisdiction of the Department of the Interior, it is necessary to know definitely what mileage of roads on the Federal Aid and State Highway Systems can qualify. In order to determine this, the Department is making a complete survey of the various classes of land over which the roads on the State Highway System pass. Since this is a big undertaking it will be several months before all the necessary data are compiled.

Inasmuch as the roads qualifying for improvement may pass alternately through public and private land a map is being compiled showing the classification of all lands. From the work that has already been accomplished along these lines the following information has been compiled:

Road Mileage by State Routes Eligible for Improvement Under the Oddie-Colton Bill

ROUTE 1

From California-Nevada state line west of Verdi to Nevada-Utah state line near Wendover via Fernley, Lovelock, Winnemucca, Battle Mountain, Carlin, Elko and Wells.

Total length of road on route	419.97 miles
Length over unappropriated lands	170.20 miles
Per cent of total length eligible for improvement	40.5

ROUTES 2 AND 24

From junction of Route 1 at Fernley to Nevada-Utah state line near Wendover via Hazen, Fallon, Austin, Eureka, Ely, East Ely, McGill and Magnuson's.

Total length of road on Routes 2 and 24	409.46 miles
Length over unappropriated lands	338.25 miles
Per cent of total length eligible for improvement	82.6
Total in Forest Reservations and not eligible	14.3 miles

ROUTE 3

From Reno to Carson City, thence to the Nevada-California state line near Lakeside. Beginning again at Carson City and ending at the Nevada-California state line near Oasis, via Minden, Gardnerville, Wellington, Yerington, Hawthorne, Luning, Mina, Miller's, Tonopah, Goldfield, Lida and Palmetto Canyon.

Total length of road on Route 3	354.71 miles
Length over unappropriated lands	232.47 miles
Per cent eligible for improvement	65.53
Length over Indian lands	13.05 miles
Per cent of total length eligible for improvement	69.21

ROUTE 4

Commencing at the city of Ely and running in a general southwesterly direction to the town of Tonopah.

Total length of road on Route 4	170.99 miles
Length over unappropriated lands	138.93 miles
Per cent of total length eligible for improvement	81.25
Total in Forest Reservations and not eligible	22.91 miles

ROUTE 5

From Goldfield to Las Vegas via Beatty, thence to state line via Searchlight.

Total length of road on Route 5	260.52 miles
Length over unappropriated lands	231.26 miles
Per cent of total length eligible for improvement	88.77

ROUTE 6

From Nevada-California state line to Nevada-Arizona state line via Jean, Las Vegas, Glendale, Bunkerville and Mesquite.

Total length of road on Route 6	129.41 miles
Length over unappropriated lands	106.44 miles
Per cent of total length eligible for improvement	82.25

NOTE—The foregoing table is only partially completed. When finished it will include all highway routes designated by the State Highway Law.

To avoid confusion in improving "main roads" that may pass alternately through unappropriated government and privately owned lands, an amendment to the Oddie-Colton Bill has been arranged for. This amendment provides that the Federal Government may build without State participation across townships where the Government owns 50 per cent or more of the land.

THE NEVADA FEDERAL HIGHWAY SYSTEM

One of the most important features in the amended Federal Highway Act of 1921 is that portion which provides for the Seven Per Cent Federal Aid Highway System, which is set forth in section 6, as follows:

> SEC. 6. That in approving projects to receive Federal aid under the provisions of this Act the Secretary of Agriculture

shall give preference to such projects as will expedite the completion of an adequate and connecting system of highways, interstate in character.

Before any projects are approved in any State, such State, through its State highway department shall select or designate a system of highways not to exceed 7 per centum of the total highway mileage of such State as shown by the records of the State highway department at the time of the passage of this Act.

Upon this system all Federal aid apportionments shall be expended.

Highways which may receive Federal aid shall be divided into two classes, one of which shall be known as primary or interstate highways, and shall not exceed three-sevenths of the total mileage which may receive Federal aid, and the other which shall connect or correlate therewith and be known as secondary or intercounty highways, and shall consist of the remainder of the mileage which may receive Federal aid.

The Secretary of Agriculture shall have authority to approve in whole or in part the systems as designated or to require modifications or revisions thereof; *provided,* that the States shall submit to the Secretary of Agriculture, for his approval, any proposed revisions of the designated systems of highways above provided for.

Not more than 60 per centum of all Federal aid allotted to any State shall be expended upon the primary or interstate highways until provision has been made for the improvement of the entire system of such highways; *provided,* that with the approval of any State highway department the Secretary of Agriculture may approve the expenditure of more than 60 per centum of the Federal aid apportioned to such State upon the primary or interstate highways in such State.

The Secretary of Agriculture may approve projects submitted by the State highway departments prior to the selection, designation, and approval of the system of Federal aid highways herein provided for if he may reasonably anticipate that such projects will become a part of such system.

Whenever provision has been made by any State for the completion and maintenance of a system of primary or interstate and secondary or intercounty highways equal to 7 per centum of the total mileage of such State, as required by this Act, said State, through its State highway department, by and with the approval of the Secretary of Agriculture, is hereby authorized to add to the mileage of primary or interstate and secondary or intercounty systems as funds become available for the construction and maintenance of such additional mileage.

Soon after the passage of the amended Federal Highway Act the Department selected a system of roads in accordance with section 6. In making the selection a careful survey of the roads in each county was made and from this survey the total road mileage of the State was

found to be approximately 22,000 miles; and from the total mileage 1,540 miles were designated as Nevada's Seven Per Cent Federal Aid Highway System, which was approved subsequently by the Secretary of Agriculture. Since then several changes have been made in the originally designated mileage, and additional mileage was allowed by section 3 of the amendment of May 21, 1928. This section is as follows:

> The system of Federal aid highways on which Federal funds may be expended in any State may exceed 7 per centum of the total highway mileage of such State by the mileage of roads on said system within national forest, Indian, or other Federal reservations therein.

The following is the revised log of the Federal Aid Highway System in Nevada:

REVISED LOG—FEDERAL AID HIGHWAY SYSTEM

FEDERAL AID ROUTE NO. 1

F. A. Project	Termini	Type	Length, miles	Remarks
73-B	Calif. State Line-2 Mi. E. of Verdi	P. C. Concr.	5.74	
73-A	2 Mi. E. of Verdi-Lawton's	P. C. Concr.	3.79	
26	Lawton's-Reno	P. C. Concr.	4.22	
	Through Reno		1.44	Ineligible.
21	Reno-Sparks	P. C. Concr.	0.97	
48	In Sparks	Asp. Concr.	1.59	
	In Sparks	Asp. Concr.	0.66	Ineligible.
65-B	Sparks-Vista	Oil Mix Cr. Rock	2.54	
65-A	Vista-Hafed	Oil Mix Cr. Rock	5.25	
98-A	Hafed-Clark	Oil Mix Cr. Rock	8.33	
98-B	Clark-0.7 Mi. W. of Derby	Oil Mix Cr. Rock	6.48	
	0.7 Mi. W. of Derby-Derby	Oil Mix Cr. Rock	0.68	Con. by State.
84-A and B	Derby-Fernley	Oil Mix Cr. Gr.	8.56	
66-B	Fernley-Junction Route No. 2	Oil Mix Cr. Gr.	0.98	
79-C	Fernley Overhead and Approaches	Oil Mix Cr. Gr.	0.35	
79-A	Fernley-Fanning	Oil Mix Cr. Gr.	31.63	
79-A	Fernley-Fanning	Cr. Gravel	7.80	
79-B	Fanning-Lovelock	Oil Mix Cr. Gr.	17.75	
	Through Lovelock	Oil Mix Cr. Gr.	1.23	Con. by City.
1	Lovelock-Zola	Oil Mix Cr. Gr.	16.65	
19	Zola-Mill City	Oil Mix Cr. Gr.	26.69	
91	Mill City-Pershing-Humboldt County line	Oil Mix Cr. Gr.	13.69	
58-A and B	County line-Winnemucca	Oil Mix Cr. Gr.	13.20	
76-A	In Winnemucca	Oil Mix Cr. Gr.	0.63	
76-A	In Winnemucca	P. C. Concrete	0.78	
76-B	In Winnemucca	Cr. Gravel	0.97	
82-A and B	Winnemucca-5 Mi. W. of Valmy	Cr. Gravel	26.36	
82-A and B	Winnemucca-5 Mi. W. of Valmy	Oil Mix Cr. Gr.	6.57	
47	5 Mi. W. of Valmy-1.7 Mi. W. Valmy	Oil Mix Cr. Gr.	3.33	
32	1.7 Mi. W. of Valmy-Humboldt-Lander Co. line	Oil Mix Cr. Gr.	7.51	
16	Humboldt-Lander Co. line-Battle Mountain	Oil Mix Cr. Gr.	8.52	
92-A	Through Battle Mountain	P. C. Concrete	0.31	
92-A	Battle Mountain-Lander-Eureka Co. line	Cr. Gravel	19.68	
22-A and B	Lander-Eureka Co. line-Dunphy	Cr. Gravel	4.87	
92-C and D	Dunphy-Eureka-Elko Co. line	Cr. Gravel	22.45	
15	Eureka-Elko Co. line-Vivian	Oil Mix Cr. Gr.	7.16	
5	Vivian-Elko	Oil Mix Cr. Gr.	18.66	
81	Through Elko	Oil Mix Cr. Gr.	1.21	
81	Through Elko	P. C. Concrete	0.71	
18	Elko-Halleck	Oil Mix Cr. Gravel	19.73	

REVISED LOG, FEDERAL AID HIGHWAY SYSTEM—*Continued.*

F. A. Project	Termini	Type	Length, miles	Remarks
74	Halleck-Deeth	Oil Mix Cr Gravel	11.71	
54-A, B, and 75	Deeth-Wells	Crushed Gravel	17.82	
90-D, A, B, E, C	Wells-Utah line	Crushed Gravel	60.78	
	Total, Federal Aid Route No. 1		419.98	
	Less Ineligible Mileage		2.10	
	Total Eligible Mileage		417.88	
	FEDERAL AID ROUTE NO. 2			
66-B	Junction Route 1-3 Mi. E. of Fernley	Oil Mix Cr. Grav.	1.78	
66-A	3 Mi. E. of Fernley-Hazen	Oil Mix Cr. Grav.	9.35	
34	Hazen-Leeteville	Oil Mix Cr. Grav.	8.26	
3	Leeteville-Fallon	Oil Mix Cr. Grav.	7.61	
49	Through Fallon	P. C. Concrete	1.22	
64-A	Fallon-5 Mi. South	Bit. Macadam	4.99	
64-B	5 Mi. S. of Fallon-Grimes	Cr. Gravel	5.08	
24-B	Grimes-Salt Wells	Cr. Gravel	5.07	
24-B&A	Salt Wells-Sand Springs	Oil Mix Cr. Grav.	11.70	
100-B	Sand Springs-1½ Mi. W. of Frenchman's	Cr. Gravel	6.54	
45	1½ Mi. W. Frenchman's-3½ Mi. E.	Cr. Gravel	5.00	
100-A	3½ Mi. E. of Frenchman's-Westgate	Cr. Gravel	7.70	
55	Westgate-Eastgate	Cr. Gravel	10.24	
56-A	Eastgate-Carroll Summit	Graded	5.01	
56-A	Eastgate-Carroll Summit	Cr. Gravel	6.74	
56-B	Carroll Summit-Campbell Ranch	Selected Mat'l.	2.55	
56-B	Carroll Summit-Campbell Ranch	Graded	3.62	
57	Campbell Cr. Ranch-Railroad Pass	Cr. Gravel	18.02	
	Railroad Pass-Austin	Cr. Gravel	19.46	Forest Hwy.
96-A	Through Austin	Selected Mat'l.	1.46	
93-B	Austin-11 Mi. East	Selected Mat'l.	10.95	
	11 Mi. E. Austin-12.5 Mi. E.	Graded	1.41	Forest Hwy.
	12.5 Mi. E. Austin-18.5 Mi. East	Cr. Gravel	6.07	Forest Hwy.
	18.5 Mi. E. Austin-22.7 Mi. East	Graded	4.20	Forest Hwy.
	22.7 Mi. E. Austin-14 Mi. West of Hay Ranch	Cr. Gravel	21.83	Forest Hwy.
93-A	14 Mi. W. Hay Ranch-Hay Ranch	Cr. Gravel	13.83	
31	Hay Ranch-Eureka	Oil Mix Cr. Grav.	11.13	
78-A	Eureka-Eureka-White Pine Co. line	Oil Mix Cr. Grav.	0.52	
78-A	Eureka-Eureka-White Pine Co. line	Crushed Gravel	10.19	
78-B	Eureka-White Pine Co. line-Pancake Summit	Crushed Gravel	13.65	
44	Pancake Summit-Illipah Summit	Crushed Gravel	22.80	

10	Illipah Summit-Robinson Summit	Crushed Gravel	15.01	
6	Robinson Summit-Keystone	Oil Mix Cr. Gr.	12.26	
25-A and B	Keystone-Ely	Oil Mix Cr. Gr.	4.38	
70	Through Ely	Oil Mix Cr. Gr.	0.98	
70	Through Ely	P. C. Concrete	0.58	
	Ely-Conners Pass For. Hwy.	Unimproved	18.00	
107-A	Conners Pass	Cr. Gravel	4.96	
	Conners Pass	Cr. Gravel	4.10	Forest Hwy.
94-C and D	Conners Pass-7 Mi. N. of White Pine-Lincoln Co. line	Cr. Gravel	20.08	
94-A and B	County line-Dutch John's	Cr. Gravel	22.13	
69	Dutch John's-Pony Springs	Cr. Gravel	9.56	
94-E	Pony Springs-Stone House	Cr. Gravel	15.74	
68	Stone House-Pioche	Selected Mat'l	1.10	
68	Stone House-Pioche	Graded	12.41	
	Total, Federal Aid Route 2		399.57	

FEDERAL AID ROUTE NO. 3

36	Calif. State line-Reno	Bit. Macadam	15.57	
	Through Reno		1.21	Ineligible.
9	Reno-Huffakers	P. C. Concrete	5.42	
7	Huffakers-Washoe Summit	P. C. Concrete	9.30	
29-A	Washoe Summit-Bower's Mansion	P. C. Concrete	4.69	
29-B	Bower's-Washoe-Ormsby Co. line	P. C. Concrete	5.78	
30	Co. line-Carson City	P. C. Concrete	3.48	
60	Through Carson City	P. C. Concrete	0.49	
	Through Carson City	P. C. Concrete	0.54	Con. by City.
99	Carson City-8.4 Mi. N. Minden	Oil Mix Cr. Gr.	5.96	
38-A and B	8.4 Mi. N. Minden-6.0 Mi. N. of Minden	Oil Mix Cr. Gr.	2.42	
99	6 Mi. N. Minden-3.4 Mi. N. Minden	Oil Mix Cr. Gr.	2.61	
14	3.4 Mi. N. Minden-Minden	Oil Mix Cr. Gr.	3.44	
28	Minden-Gardnerville	P. C. Concrete	1.80	
108	Gardnerville-2 Mi. N. Carters	Oil Mix Cr. Gr.	7.19	
4	2 Mi. N. Carters-3 Mi. N. of Holbrook	Cr. Gravel	6.69	
89-C, B and A	3 Mi. N. Holbrook-Smith's Cor.	Cr. Gravel	20.08	Incl. 0.40 Mi. Exception.
12	Smith's Cor.-Hudson Aurora Rd.	Cr. Gravel	2.22	
8-A	Hudson-Aurora Road-Bulkhead	Cr. Gravel	4.19	
8-B and C	Bulkhead-Wilson	Graded	2.75	
33-A and B	Wilson-5.72 Mi. S. Yerington	Selected Mat'l	1.02	
33-A and B	Wilson-5.72 Mi. S. Yerington	Oil Mix Cr. Gr.	6.02	
17	5.72 Mi. S. of Yerington-Yerington	Oil Mix Cr. Gr.	5.72	
59	Through Yerington	P. C. Concrete	1.43	
80-A and B	Yerington-Schurz	Cr. Gravel	24.41	

REVISED LOG, FEDERAL AID HIGHWAY SYSTEM—*Continued.*

F. A. Project	Termini	Type	Length, miles	Remarks
	Schurz-10 Mi. N. Cottonwood Cr.	Unimproved	11.61	
23	10 Mi. N. Cottonwood Cr.-Dutch Creek	Graded	11.06	
	Dutch Creek-Hawthorne	Unimproved	10.43	
97-F	Hawthorne-12.7 Mi. E. of Hawthorne	Cr. Gravel	13.65	
97-E	12.7 Mi. E. of Hawthorne-3.3 Mi. W. of Luning	Cr. Gravel	8.48	
97-D	3.3 Mi. W. of Luning-Rhodes	Cr. Gravel	20.02	
97-C	Rhodes-Coaldale	Cr. Gravel	20.87	
97-B	Coaldale-8 Mi. W. of Millers	Cr. Gravel	20.00	
97-A	8 Mi. W. of Miller's-Esmeralda-Nye Co. line	Cr. Gravel	3.16	
97-A	8 Mi. W. of Miller's-Esmeralda-Nye Co. line	Oil Mix Cr. Gr.	16.78	
88	County line-Tonopah	Oil Mix Cr. Gr.	0.63	
	Through Tonopah	Oil Mix Cr. Gr.	2.24	Ineligible.
11	Tonopah-Miller's Cut-off Road	Graded	8.93	
103	Miller's Cut-off Road-Goldfield	Oil Mix Cr. Gr.	15.76	
	Goldfield-6.0 Mi. South	Unimproved	6.02	
	6.0 Mi. S. Goldfield-Lyda	Unimproved	22.16	
	Lyda-California State line	Unimproved	14.00	
	Total, Federal Aid Route No. 3		350.23	
	Less Ineligible Mileage		3.45	
	Total eligible mileage		346.78	
	FEDERAL AID ROUTE NO. 4			
	Calif. State line-Glenbrook	Unimproved	9.31	Forest Hwy.
	Glenbrook-Spooner's	Cr. Rock	3.09	Forest Hwy.
102-A	Spooner's-Junction Route 3	Graded	8.36	
102-A	Spooner's-Junction Route 3	Oil Mix Sel. M.	0.65	
102-A	Spooner's-Junction Route 3	Oil Mix Cr. Gr.	1.32	
112	Carson City-Moundhouse	Oil Mix Cr. Gr.	5.66	
	Total, Federal Aid Route No. 4		28.39	
	FEDERAL AID ROUTE NO. 5			
53-C	Arizona Line-Mesquite	Oil Mix Cr. Gravel	1.07	
53-A, B, & 27	Mesquite-E. slope Mormon Mesa	Crushed Gravel	10.06	
53-A, B, & 27	Mesquite-E. slope Mormon Mesa	Graded	6.01	
52	E. slope Mormon Mesa-West slope	Cr. Gravel	16.02	
43-A and B	West slope Mormon Mesa-Crystal	Oil Mix Cr. Gr.	20.26	
37-A	Crystal-2 Mi. S. W. Dry Lake	Oil Mix Cr. Gr.	8.42	
37-B	2 Mi. S. W. Dry Lake-2 Mi. N. E. of Apex	Oil Mix Cr. Gr.	6.32	
42	2 Mi. N. E. Apex-6 Mi. S. W. of Apex	Oil Mix Cr. Gr.	7.95	

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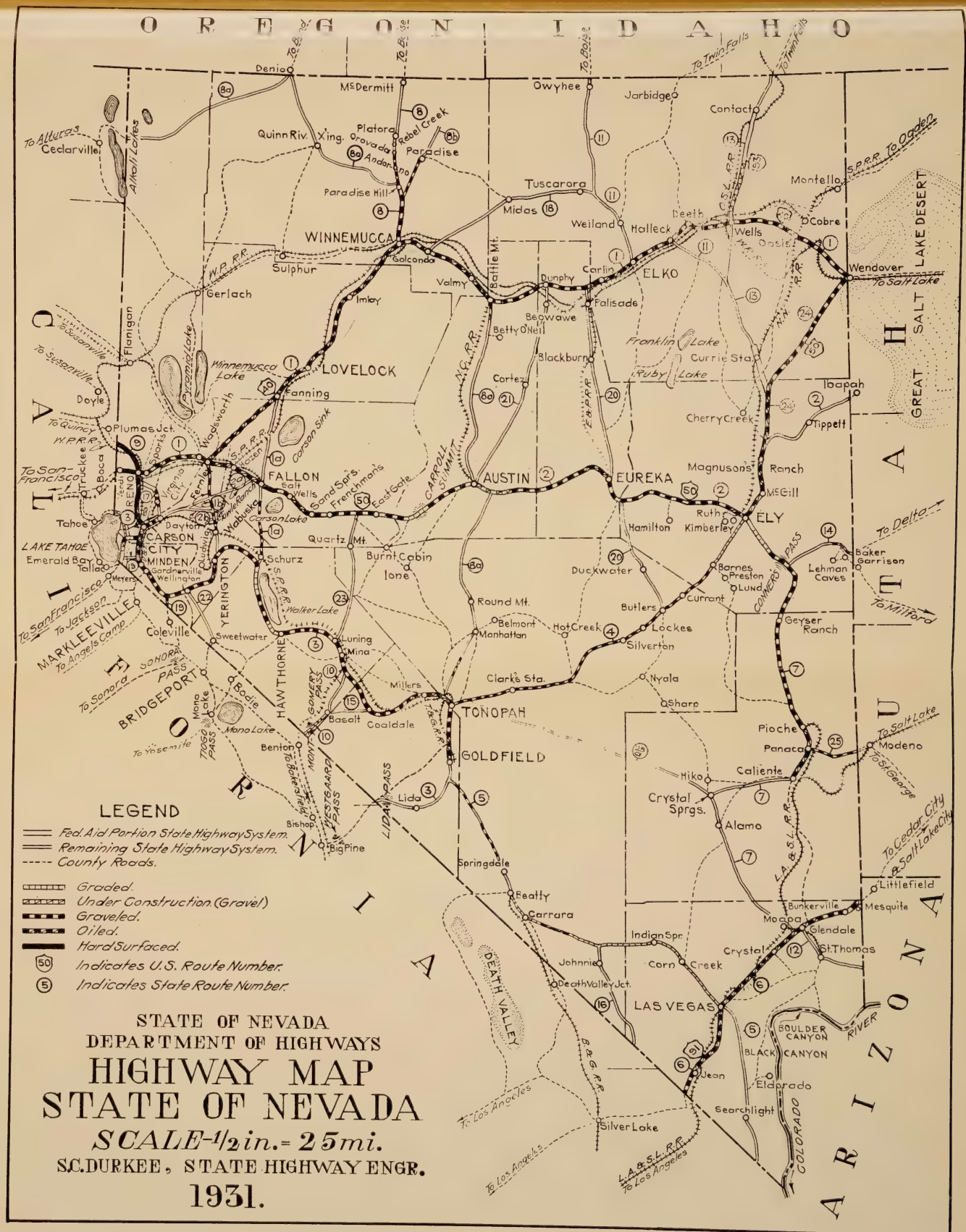
REVISED LOG, FEDERAL AID HIGHWAY SYSTEM—*Continued.*

F. A. Project	Termini	Type	Length, miles	Remarks
	Schurz-10 Mi. N. Cottonwood Cr.	Unimproved	11.61	
23	10 Mi. N. Cottonwood Cr.-Dutch Creek	Graded	11.06	
	Dutch Creek-Hawthorne	Unimproved	10.43	
97-F	Hawthorne-12.7 Mi. E. of Hawthorne	Cr. Gravel	13.65	
97-E	12.7 Mi. E. of Hawthorne-3.3 Mi. W. of Luning	Cr. Gravel	8.48	
97-D	3.3 Mi. W. of Luning-Rhodes	Cr. Gravel	20.02	
97-C	Rhodes-Coaldale	Cr. Gravel	20.87	
97-B	Coaldale-8 Mi. W. of Millers	Cr. Gravel	20.00	
97-A	8 Mi. W. of Miller's-Esmeralda-Nye Co. line	Cr. Gravel	3.16	
97-A	8 Mi. W. of Miller's-Esmeralda-Nye Co. line	Oil Mix Cr. Gr.	16.78	
88	County line-Tonopah	Oil Mix Cr. Gr.	0.63	
	Through Tonopah	Oil Mix Cr. Gr.	2.24	Ineligible.
11	Tonopah-Miller's Cut-off Road	Graded	8.93	
103	Miller's Cut-off Road-Goldfield	Oil Mix Cr. Gr.	15.76	
	Goldfield-6.0 Mi. South	Unimproved	6.02	
	6.0 Mi. S. Goldfield-Lyda	Unimproved	22.16	
	Lyda-California State line	Unimproved	14.00	
	Total, Federal Aid Route No. 3		350.23	
	Less Ineligible Mileage		3.15	
	Total eligible mileage		346.78	
	FEDERAL AID ROUTE NO. 4			
	Calif. State line-Glenbrook	Unimproved	9.31	Forest Hwy.
	Glenbrook-Spooner's	Cr. Rock	3.09	Forest Hwy.
102-A	Spooner's-Junction Route 3	Graded	8.36	
102-A	Spooner's-Junction Route 3	Oil Mix Sel. M.	0.65	
102-A	Spooner's-Junction Route 3	Oil Mix Cr. Gr.	1.32	
112	Carson City-Moundhouse	Oil Mix Cr. Gr.	5.66	
	Total, Federal Aid Route No. 4		28.39	
	FEDERAL AID ROUTE NO. 5			
53-C	Arizona Line-Mesquite	Oil Mix Cr. Gravel	1.07	
53-A, B, & 27	Mesquite-E. slope Mormon Mesa	Crushed Gravel	10.06	
53-A, B, & 27	Mesquite-E. slope Mormon Mesa	Graded	6.01	
52	E. slope Mormon Mesa-West slope	Cr. Gravel	16.02	
43-A and B	West slope Mormon Mesa-Crystal	Oil Mix Cr. Gr.	20.26	
37-A	Crystal-2 Mi. S. W. Dry Lake	Oil Mix Cr. Gr.	8.42	
37-B	2 Mi. S. W. Dry Lake-2 Mi. N. E. of Apex	Oil Mix Cr. Gr.	6.32	
42	2 Mi. N. E. Apex-6 Mi. S. W. of Apex	Oil Mix Cr. Gr.	7.95	



STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

HIGHWAY MAP STATE OF NEVADA

SCALE-1/2 in. = 25 mi.

S.C. DURKEE, STATE HIGHWAY ENGR.

1931.

83	6 Mi. S. W. of Apex-Las Vegas	Oil Mix Cr. Gr.	8.64	
87-A	Through Las Vegas	Oil Mix Cr. Gr.	1.61	
87-A	Through Las Vegas	Asp. Concrete	0.37	
101-A	Las Vegas-Bard	Oil Mix Cr. Gr.	13.89	
101-B	Bard-Jean	Oil Mix Cr. Gr.	16.27	
101-C	Jean-Calif. State line	Oil Mix Cr. Gr.	12.62	
	Total, Federal Aid Route No. 5		129.51	
	FEDERAL AID ROUTE NO. 6			
86-A	Through Winnemucca	P. C. Concrete	0.20	
86-A	Through Winnemucca	Cr. Gravel	1.02	Incl. 0.14 Mi., Exception.
71 and 72	Winnemucca-Paradise Hill	Cr. Gravel	24.12	
	Total, Federal Aid Route No. 6		25.34	
	FEDERAL AID ROUTE NO. 7			
77	Ely-McGill	Oil Mix Cr. Grav.	11.51	
	Through McGill	Oil Mix Cr. Grav.	1.02	Ineligible.
109-A	McGill-Magnuson Ranch	Oil Mix Cr. Grav.	17.56	
109-C	Magnuson Ranch-14.5 Mi. N. E.	Oil Mix Cr. Grav.	14.47	
109-D	14.5 Mi. N. E. Magnuson's-White Pine-Elko Co. line	Oil Mix Cr. Grav.	20.28	
109-E	White Pine-Elko Co. line-Junction Route No. 1	Crushed Gravel	53.39	
	Total, Federal Aid Route No. 7		118.23	
	Less ineligible mileage		1.02	
	Total Eligible Mileage		117.21	
	FEDERAL AID ROUTE NO. 8			
	Junction Route No. 3-Washoe-Storey Co. line	Unimproved	6.60	
95-A	County line-Virginia City	Cr. Gravel	5.40	
	Total, Federal Aid Route No. 8		12.00	
	FEDERAL AID ROUTE NO. 9			
	Wells-Contact	Unimproved	26.79	
110-B	Wells-Contact	Cr. Gravel	23.21	
	Total, Federal Aid Route No. 9		50.00	
	FEDERAL AID ROUTE NO. 10			
	Junction Route No. 7 to 5.21 Mi. north of Currie	Unimproved	21.69	

NOTE—Federal Aid Route numbers as shown in this table do not correspond with State Route numbers.

SUMMARY

Mileage—Nevada Federal Aid Highway System

Route No.	Total eligible mileage	Total ineligible mileage
1	417.88	2.10
2	399.57	
3	346.78	3.45
4	28.39	
5	129.51	
6	25.34	
7	117.21	1.02
8	12.00	
9	50.00	
10	21.69	
Totals	1,548.37	6.57

Additional Mileage Allowed by Section 3 of Act Approved May 1, 1928, as Revised by Surveys

Pyramid Lake Indian Reservation	2.39
Walker Lake Indian Reservation	4.87
Toiyabe National Forest	9.38
Nevada National Forest	5.13
	21.77
Mileage allowed in original Federal Aid System	1,540.00
Total	1,561.77
Total eligible mileage in approved routes	1,548.37
Balance available for new mileage	13.40

CONSTRUCTION ACTIVITIES

VICTORY HIGHWAY WEST OF VERDI.

CONSTRUCTION ACTIVITIES

Prior to the beginning of this biennial period the Department of Highways outlined a tentative program covering the proposed highway improvements for the years 1929 and 1930. This plan included completion of the Lincoln Highway between Wendover and McGill; additional construction on the North and South Highway; construction of a section from Wells north toward Contact, on the Wells-Rogerson Highway; and reconstruction and oiling of certain sections of the Victory Highway and Arrowhead Trail. During 1929 improvements were made in accordance with this plan. In 1930 it was necessary to enlarge and rearrange the original plan in order to utilize the increased Federal aid funds which became available July 1, 1930.

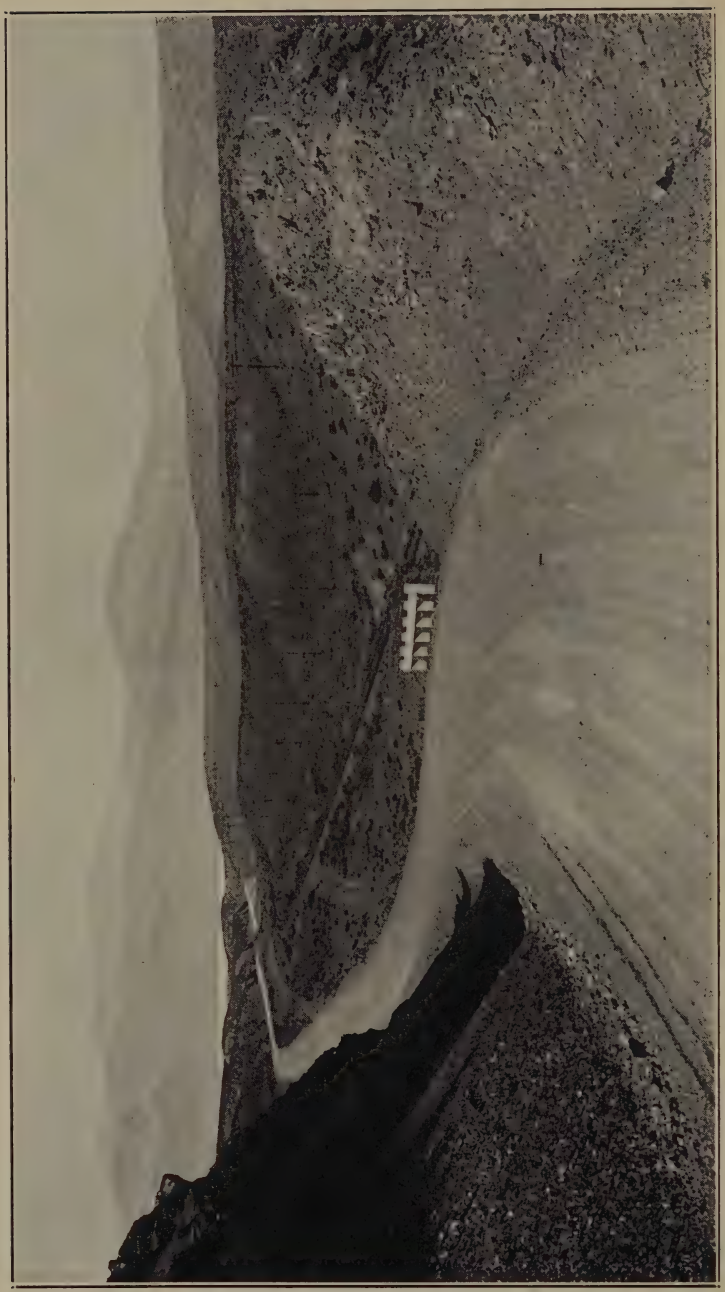
Due to progressive State legislation and increased Federal aid

VICTORY HIGHWAY WEST OF RENO.

accomplishments in highway improvements during this biennium far exceeded the most optimistic expectations of the Department.

ORGANIZATION AND ENGINEERING POLICIES

In 1927, soon after the present Board of Directors assumed control of the Highway Department, a redistribution of the engineering responsibilities was made by reducing the supervising engineering forces. This effected a large saving in the overhead expense of maintaining the various subdivisions of the Department. Under this arrangement the division engineer has direct supervision over all activities in his division. Heretofore the maintenance work was carried on as a separate and distinct organization in charge of a maintenance



HIGHWAY SOUTH OF MINA. STATE ROUTE NO. 3.

engineer whose responsibilities and authority at times encroached upon the duties of the division engineers. Naturally this condition caused a great deal of confusion and duplication of authority, which was adverse to administering the affairs of the Department economically and efficiently. However, certain well-defined policies were formulated under this organization arrangement, and these still govern maintenance operations.

During the early part of 1929 the Department's organization was increased by the addition of another engineering division, designated as Division 5, with offices and repair shops located in Tonopah. This increase was necessary to facilitate highway operations in the territory from Beatty north to Hawthorne and from Tonopah northeast to Currant. For years the roads in Esmeralda and Nye Counties had been under the jurisdiction of Division 1, and the roads in Mineral County under Division 2, which was entirely satisfactory until construction and maintenance operations were increased to such an extent that the work could not be properly administered and supervised. The improvement of the North and South Highway from Hawthorne to Springdale, and the vast amount of betterment work on the roads in the vicinity of Tonopah, besides the increased maintenance operations, made it imperative to establish another engineering division and designate new division boundaries.

For construction and maintenance purposes the State is now divided as follows:

Division 1, with headquarters in Las Vegas, comprises all of Clark County, the south half of Lincoln County and part of Esmeralda County north to Beatty.

Division 2, with headquarters in Reno, comprises all of Washoe, Storey, Churchill, Ormsby and Lyon Counties, the north half of Mineral County, the west half of Pershing and the south half of Lander County.

Division 3, with headquarters in Elko, comprises practically all of Elko County, the north half of Lander and Eureka Counties, the east half of Pershing County and all of Humboldt County.

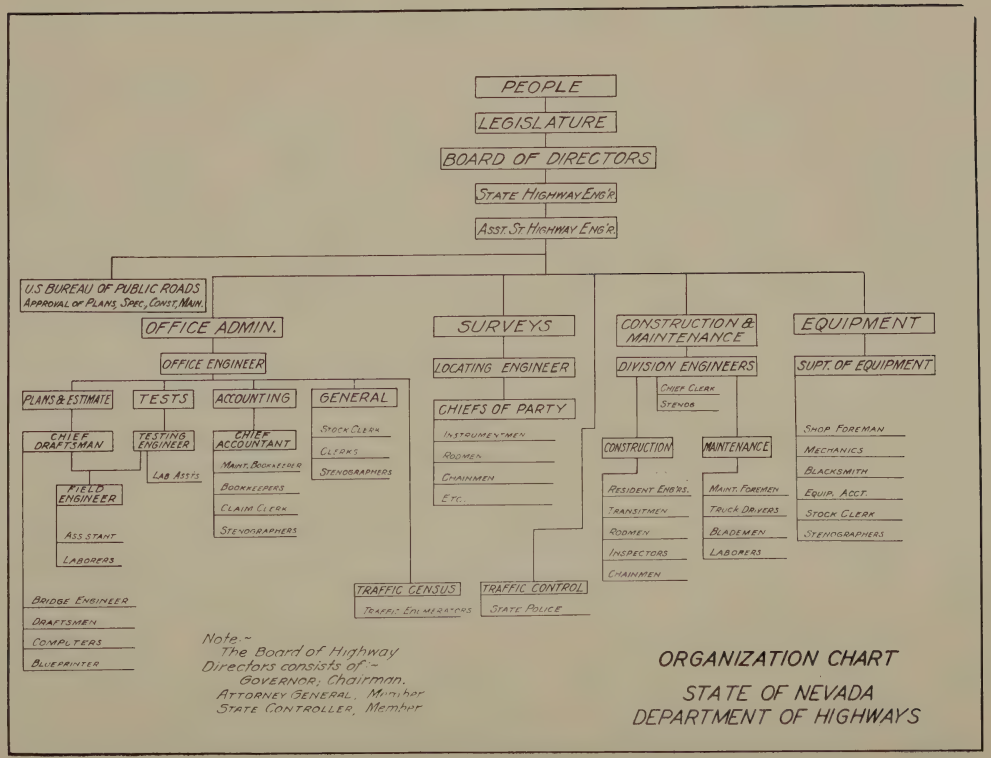
Division 4, with headquarters in East Ely, comprises White Pine and Eureka Counties, a small portion of Elko County and the north half of Lincoln County.

Division 5, with headquarters in Tonopah, comprises all of Esmeralda County, the east half of Mineral County and all of Nye County with the exception of that portion lying south of Beatty.

ENGINEERS' MANUAL OF INSTRUCTIONS

During the biennium the Engineers' Manual has been revised in an endeavor to facilitate the systematic conduct of the field engineering and supervising forces. In order to coordinate the work of the various divisions of the Department, methods have been outlined and policies adopted to standardize engineering activities on all work. Each supervising engineer is furnished with a copy of this manual with instructions to become thoroughly familiar with its provisions.

Under the heading of "Duties and Responsibilities" the employees are instructed to always be courteous in their relations with the public, regardless of the provocation. They are also instructed to guard


PEOPLE
LEGISLATURE
BOARD OF DIRECTORS
STATE HIGHWAY ENG'R.
ASST. ST. HIGHWAY ENG'R.
U.S. BUREAU OF PUBLIC ROADS
APPROVAL OF PLANS, SPEC., CONST. MAIN.
OFFICE ADMIN.
OFFICE ENGINEER
PLANS & ESTIMATE
CHIEF DRAFTSMAN
FIELD ENGINEER
ASSISTANT
LABORERS
BRIDGE ENGINEER
DRAFTSMEN
COMPUTERS
BLUEPRINTER
TESTS
TESTING ENGINEER
LAB ASST'S.
ACCOUNTING
CHIEF ACCOUNTANT
MAINT. BOOKKEEPER
BOOKKEEPERS
CLAIM CLERK
STENOGRAPHERS
GENERAL
STOCK CLERK
CLERKS
STENOGRAPHERS
SURVEYS
LOCATING ENGINEER
CHIEFS OF PARTY
INSTRUMENTMEN
RODMEN
CHAINMEN
ETC...
TRAFFIC CENSUS
TRAFFIC ENUMERATORS
TRAFFIC CONTROL
STATE POLICE
CONSTRUCTION & MAINTENANCE
DIVISION ENGINEERS
CHIEF CLERK
STENOG.
CONSTRUCTION
RESIDENT ENG'RS.
TRANSITMEN
RODMEN
INSPECTORS
CHAINMEN
MAINTENANCE
MAINT. FOREMEN
TRUCK DRIVERS
BLADEMEN
LABORERS
EQUIPMENT
SUPT. OF EQUIPMENT
SHOP FOREMAN
MECHANICS
BLACKSMITH
EQUIP. ACCT.
STOCK CLERK
STENOGRAPHERS
Note.-
The Board of Highway
Directors consists of:-
GOVERNOR; Chairman.
ATTORNEY GENERAL, Member
STATE CONTROLLER, Member
ORGANIZATION CHART
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

against becoming a party to any local or political controversy and to refrain from committing any act that will inconvenience the public or reflect upon the Department.

Furthermore, they are expected to cooperate and be agreeable with the contractor and gain the good will of everyone connected with the work by attending strictly to their own affairs.

The resident engineer in charge of construction is responsible for an accurate accounting of all work performed. For a guide standard methods have been outlined governing the keeping of all notes relative to the various items of work. In addition, sample pages of each type of notebook used and numerous formulas have been included with the general instructions, beside several tables that are exceedingly useful in preparing the final estimate.

On all projects the resident engineer is instructed to keep a diary as part of the records showing the progress of the work, and the following information:

(1) Daily time data.

(2) Salient developments.

(3) Important understandings with the contractor or his representatives.

(4) Record of important conversations relative to the work.

(5) Data not recorded in other books which might have a bearing in the future, should details come into dispute.

(6) Record of dates and cost data.

(7) All information relative to equipment, labor, materials used on extra work.

(8) Explanations for additional and extra work.

With the above-listed information recorded daily, a short letter giving a general resumé of the work accomplished during the week is compiled and submitted to the Division Engineer at the end of each week.

Inasmuch as the actual field engineering and supervising is of major importance to work in general, constant endeavor is made by the Department to eliminate the duplication of effort and all unnecessary paper work. For this reason additional and supplementary instructions are issued whenever new policies or methods governing the work are established.

AVERAGE BID PRICES

The average bid prices received during 1930 were about equal to those received during 1929. It has been noted, however, that the average bid price submitted for "Crushed Gravel or Crushed Rock in Place" was appreciably lower for 1930. The decrease may be accounted for by the fact that the quantity of surfacing material used per mile during 1930 exceeded the amount previously used. Contract prices for all items of work vary according to the numerous factors affecting the design of the roadbed and its facilities, as well as the physical, topographical, climatic and soil conditions involved.

During the past few years, or since about 1925, the impetus given highway construction through the equitable aid of the Federal Government has gradually caused highway contractors to adopt the most modern methods. This has necessitated not only a trained organization of skilled workmen but the standardization of all types of equipment as well. Fortunately, the contractors doing the bulk of the work

in Nevada have equipped and organized themselves to perform the work in the most economical manner. From these efficient contracting organizations the Department has been able to obtain commendable results at exceedingly fair prices.

Each succeeding year the specifications are revised to include more refinements in the way the work is to be done, especially the finishing; and each year the contractors have met the demands by modernizing their organization to do the work accordingly.

In order to secure practical application of the work done by contract the Department cooperates with the contractors and representatives of the Bureau of Public Roads in modeling the specifications. This policy prevents the Department from making unreasonable and expensive demands that would in no way be beneficial to the final results, and gives the contractor a better understanding of the specifications. Mutual agreement as to the performance of the work has proven beneficial in every way, which is reflected in the downward trend of bid prices.

AVERAGE BID PRICES ON CONTRACTS AWARDED 1929

Unit	Item	Average bid prices 1929
Cu. Yd.	Excavation unclassified	$0.331
Cu. Yd.	Selected borrow excavation in place	0.425
Sta. Yd.	Overhaul	0.046
Mile	Prepare subgrade and shoulders	115.00
Mile	Building shoulders	175.00
Mile	Widening present roadway	275.00
Mile	Widening present gravel surface	150.00
Cu. Yd.	Crushed gravel in place	0.976
Cu. Yd.	Crushed gravel in Stockpile	0.925
Cu. Yd.	Class "A" concrete	35.00
Cu. Yd.	Class "B" concrete	37.50
Lin. Ft.	Installing 15" corrugated metal pipe	0.50
Lin. Ft.	Installing 18" corrugated metal pipe	0.578
Lin. Ft.	Installing 24" corrugated metal pipe	0.672
Lin. Ft.	Installing 30" corrugated metal pipe	0.750
Lin. Ft.	Installing 36" corrugated metal pipe	1.167
Lin. Ft.	Installing 48" corrugated metal pipe	2.00
	Pipe culvert extensions	13.50
	Demolish concrete headwalls	5.00
	Demolish cement rubble masonry headwalls	2.50
Lin. Ft.	Remove 15" corrugated metal pipe	0.75
Lin. Ft.	Remove 18" corrugated metal pipe	0.50
Lin. Ft.	Remove and reset 18" corrugated metal pipe	1.75
Lin. Ft.	Remove and reset 24" corrugated metal pipe	1.50
Lin. Ft.	Remove and reset 30" corrugated metal pipe	1.75
Cu. Yd.	Cement rubble masonry	10.00
Cu. Yd.	Rip rap	2.50
Lump Sum	Furnishing water equipment	1,250.00
M. Gal.	Applying water	2.80
	Monuments	3.286
Lin. Ft.	Construct fence	0.15
Lin. Ft.	Remove and reconstruct fence	0.08
Acres	Clearing right-of-way	200.00
Lin. Ft.	Remove present guard rail	0.30
Lin. Ft.	Standard timber guard rail in place	0.95
	Remove and reconstruct grave	50.00

CONSTRUCTION PROGRESS 1929

During the fiscal year ending November 30, 1929, the Department awarded fourteen contracts covering 168.42 miles of new construction; 163.87 miles of reconstruction; and seven contracts for furnishing and applying asphaltic oil on 209.18 miles of highway surface. In addition to the mileage completed by contract, 21.57 miles of new construction was accomplished by State forces, besides mixing and placing 216.75 miles of oil treated surface.

Although Federal aid funds for this period were about equal to those of the previous years, it was possible to accomplish more work in road construction on account of the favorable contract prices received.

CONSTRUCTION PROGRESS 1930

From December 1, 1929, to November 30, 1930, the Department awarded sixteen contracts covering 83.54 miles of new construction; 168.25 miles of reconstruction; and eight contracts pertaining to the construction of 175.09 miles of oil treated surface. In addition a contract was awarded for the construction of a reinforced concrete bridge over the East Walker River south of Yerington.

State forces reconstructed 28.6 miles of semi-improved road, and in the forepart of the season mixed and placed several miles of new oil surface, besides reconditioning a portion of the surfacing that had been previously treated.

Grading 0.45 of a mile through the town of Goldfield was done under a construction authorization as part of Contract No. 205 awarded prior to December 1, 1929.

More road mileage was improved during 1929 than in 1930; however, the character of the work on the projects completed during 1930 was much heavier and consequently more expensive.

Summary of work completed or placed under contract during the biennium:

Year	Construction	Reconstruction	Oiling	Total
1929	189.99	163.87	216.75	570.61
1930	83.99	196.85	175.09	455.93
Totals	273.98	360.72	391.84	1,026.54

REVIEW OF HIGHWAY CONSTRUCTION CARRIED ON DURING THE BIENNIUM IN THE VARIOUS COUNTIES

Churchill County

During this biennium 17.72 miles of graded and gravel surfaced highway were constructed, 36.72 miles reconstructed and 57.01 miles oil surfaced.

The new construction is on the Fallon-Schurz highway, State Route No. 1A.

The reconstructed sections lie between the west Churchill County line and Pershing County line on the Victory Highway, U. S. Route 40, and between west Churchill County line and Leeteville on Lincoln Highway, U. S. Route 50. Both of these sections were oil treated as well as the sections between Leeteville and Fallon, and between Salt Wells and Sand Springs.

The oil treating of the highway across the four and eight mile flats between Salt Wells and Sand Springs has made this section of road as fine as any of this type in the State.

Clark County

Construction during the past two years has consisted of 20.01 miles of graded and gravel surfaced highway, 36.58 miles reconstruction and 43.97 miles oil treatment.

All work has been confined to State Route No. 6, U. S. Route No. 91. The sections of new construction, gravel surface type highway are located between 2 miles northeast of Apex Summit to 2 miles southwest of Dry Lake, 6.32 miles; Mesquite to the Arizona state line, 1.07 miles, and Jean to the California state line, 12.62 miles. This latter section is still under construction but should be completed in the early

VICTORY HIGHWAY BETWEEN ELKO AND CARLIN. RAILROAD TUNNELS SHOWN ON RIGHT.

Spring of 1931. U. S. Route No. 91 is now improved or under construction for its entire length across the State, and all but approximately 43 miles has been oil treated.

The construction of the Boulder Canyon Dam, for which the preliminary work is now in progress, has made absolutely essential the early construction of a highway between the city of Las Vegas and the Boulder Dam townsite.

The highway will be approximately 25 miles in length and, anticipating a heavy travel over it both during construction of the dam and after completion, the Highway Department is designing a higher type of construction than is required for the majority of the State highways. The estimated cost is $500,000. The first 17 miles from Las Vegas are on State Route No. 5, but the balance from the junction of Route No. 5 to the townsite is not on the State Highway System, so it will be

necessary for the State Legislature to designate this portion as a part of the system prior to construction by the Highway Department. Ten miles of the route from Las Vegas south cross privately owned land, and this section will be made a part of the Federal Aid Highway System in order to take advantage of Federal participation in the cost of construction. It is planned to have this first section under construction early in February, 1931. The rest of the route crosses Government land, and if Federal funds are made available under the Colton-Oddie Bill, which was passed by the 71st Congress and approved June 24, 1930, the entire highway can be completed during 1931.

Douglas County

Highway construction during this biennium consisted of the following: Graded and drained 4.16 miles; gravel surface previously graded

STATE HIGHWAY ROUTE NO. 5 NEAR CUPRITE, NYE COUNTY.

highway 2.09 miles; graded and graveled 4.39 miles; reconstruction 3.44 miles; oil treated surface 10.63 miles.

A very important improvement was the reconstruction and oil treating of the section from Minden to 3.44 miles north on State Route No. 3. This highway as originally constructed was of narrow width, low grade line and poor drainage. As a result the section was extremely hard to keep in travelable condition, and maintenance costs were high. In reconstruction, the grade was raised, the roadway widened to 26 feet, with an oil gravel surface width of 18 feet, and the drainage adequately cared for.

The Bureau of Public Roads constructed sections of the Forest Highway System as follows: Spooners to Glenbrook, 3.08 miles consisting of 0.99 mile graded and graveled, and 2.09 miles gravel surface on previously graded highway. Spooners toward Incline, 1.28 miles

graded and drained. Junction of State Route No. 3 near Mountain House to the California state line at Topaz Lake 3.40 miles graded and graveled. Glenbrook to Cave Rock, 2.88 miles graded and drained (under construction). The cost of this work was financed from Forest Highway funds with the exception of a donation from Douglas County of $5,000 to assist in the cost of construction of the section between Mountain House and Topaz Lake.

Elko County

During this biennium 53.52 miles of graded and gravel surfaced highway were completed between the south Elko County line and Wendover on U. S. Route No. 50, and 23.22 miles between 3 miles north

STATE CONSTRUCTION ACROSS CLIFFORD FLAT ON ROUTE NO. 4.

of Wells and Thousand Springs Creek on the Wells-Rogerson Highway, U. S. Route No. 93, are under construction. There were also 57.36 miles of reconstruction completed and 27.04 miles oil treated.

The reconstructed projects lie between Elko and the west county line and Elko and Deeth. Both of these sections of highway were badly in need of reconstruction, but the outstanding improvement was the elimination of the Osini hill curve on the Elko-Deeth section by realignment of the highway.

Esmeralda County

During the years 1929–1930, 6.43 miles of graded and graveled highway were completed, 32.54 miles reconstructed, and 32.99 miles oil treated.

The reconstructed sections lie between Goldfield-Miller's cut-off road and Tonopah and 5 miles west of Miller's on State Route No. 3. These sections were oil treated.

State Route No. 3 for a distance of 0.45 mile through the city of Goldfield was constructed with an oil treated surface, and 5.98 miles on State Route No. 5 between a point 13 miles south of Goldfield and the South Esmeralda County Line were graded and graveled. This latter section is a part of the 34 miles of highway completed over the west portion of the road between Goldfield and Beatty.

Eureka County

Work in this county during the past two years consisted of the reconstruction of the highway between Hay Ranch to and through the city of Eureka on State Route No. 2, U. S. Route No. 50. The contract for the oil treatment of this section was let, but cold weather set in

LINCOLN HIGHWAY BETWEEN ELY AND WENDOVER.

before much oiling could be done, necessitating holding the work over until early next spring.

Humboldt County

During this biennium 18.60 miles of graded and gravel highway were completed; 13.73 miles reconstructed, and 31.14 miles oil treated.

The new construction lies between Paradise Hill and Orovada on what is known as the I. O. N. highway and leaves but approximately 28 miles of unimproved road between Winnemucca and Oregon state line.

The Victory Highway between the west county line and Winnemucca was reconstructed and oil treated, and 17.41 miles between a point west of Stone House to the Lander County line, which were reconstructed in 1928, were oil treated.

Lander County

Work in this county consisted of the oil treatment of a portion of the Victory Highway which was reconstructed in 1928, between Battle

Mountain and the west county line, a length of 8.52 miles; also the placing under construction of the section of the Lincoln Highway from west city limits of Austin to the east slope of the Austin summit, length 11.70 miles.

The Austin-East project is, in reality, a reconstruction job, as a highway had been constructed by the Forest Service at this point, but on account of the narrow width and many curves this original road had proven inadequate for present-day travel. The new road will be of standard width, curvature greatly reduced, and maximum grade of 6 per cent.

Lincoln County

During the past two years the State improved 20 miles of the road between Panaca and the Utah state line near Modena, which gives the northern and central portions of the State a good connection with

IGLOOS FOR STORING AMMUNITION AT NAVAL MUNITION DEPOT NEAR HAWTHORNE.

Utah roads leading to Zion Park and Brice's Canyon; also 20.73 miles of the highway between Caliente and Pioche were oil treated. All work in this county was performed without financial aid from the Federal Government.

Lyon County

Work in this county during the past two years consisted of the construction of 39.44 miles of graded and gravel surfaced highway; 19.73 miles of reconstruction, and 20.06 miles of oil treated highway. A new reinforced concrete girder bridge was also constructed across the East Walker River at a point 8 miles south of Yerington. This structure replaced the old county bridge which collapsed under a heavy load of contractor's equipment.

New construction worthy of notice was the completion of a highway

between Wabuska and Fernley via the Towle Ranch. The new road shortens considerably the distance formerly traveled between the towns of Yerington and Fernley.

Mineral County

During this biennium 21.15 miles of graded and gravel surfaced highway were constructed, 13.65 miles from Hawthorne east on State Route No. 3, completing the last unimproved portion on the highway between Hawthorne and Tonopah. The balance was on the Fallon-Schurz highway between Schurz and the north county line.

Nye County

Construction during the past two years consisted of 29.50 miles of graded and graveled highway; 29.24 miles of reconstruction, and 2.21 miles of oil treated surface.

BOULDER CANYON—SITE OF BOULDER DAM.

Of the new construction, gravel surfaced type, 27.93 miles are on State Route No. 5, between Springdale and the north county line, and 1.57 miles through the city of Tonopah.

The sections reconstructed were: 14.60 miles on State Route No. 5, south of Carrara, and 14.00 miles on State Route No. 4 between west forest boundary and Currant, also 0.64 mile in the city of Tonopah; 2.21 miles of highway through the city of Tonopah were oil treated, and this turned out to be one of the finest oil surface projects in the State.

Ormsby County

Work in this county during the past two years was confined to the construction of 4.08 miles of graded and drained highway on the Forest Highway System between Spooners and Incline, which construction was directed by the Bureau of Public Roads and financed from Forest

Highway funds; and the construction of 5.66 miles of graded and graveled highway between Carson City and Mound House on State Route No. 2A.

Pershing County

During this biennium the Victory Highway, U. S. Route No. 40, was reconstructed and the surface oil treated for the entire distance across the county with the exception of a short section where the highway crosses the Southern Pacific railroad near Woolsey. The present crossing is at grade and next year's program provides for the construction of an overhead grade separation structure.

FOREST HIGHWAY AT TOPAZ LAKE, DOUGLAS COUNTY.

The work completed consisted of 56.85 miles of reconstruction and 73.58 miles oil treatment.

Storey County

No construction was carried on in the county during 1929–1930 as the Federal Aid System was completed.

Washoe County

Highway activities were confined to the construction, by the Bureau of Public Roads, of 7 miles of graded and drained highway on the Forest Highway System at Lake Tahoe between the south county line and the California state line at Calneva; and the reconstruction by the State of the Sparks-Vista section of the Victory Highway, length 2.54 miles.

White Pine County

During this biennium 10.55 miles of graded and graveled highway were constructed; 54.02 miles reconstructed, and 54.02 miles oil treated.

The construction of the McGill-Magnuson section of the Lincoln

Highway completed the last unimproved link in this transcontinental highway across the State. The Lincoln Highway from McGill to the north county line, 52.31 miles, was oil treated, and the oil treatment of the balance of the route to Wendover is in the program for 1931.

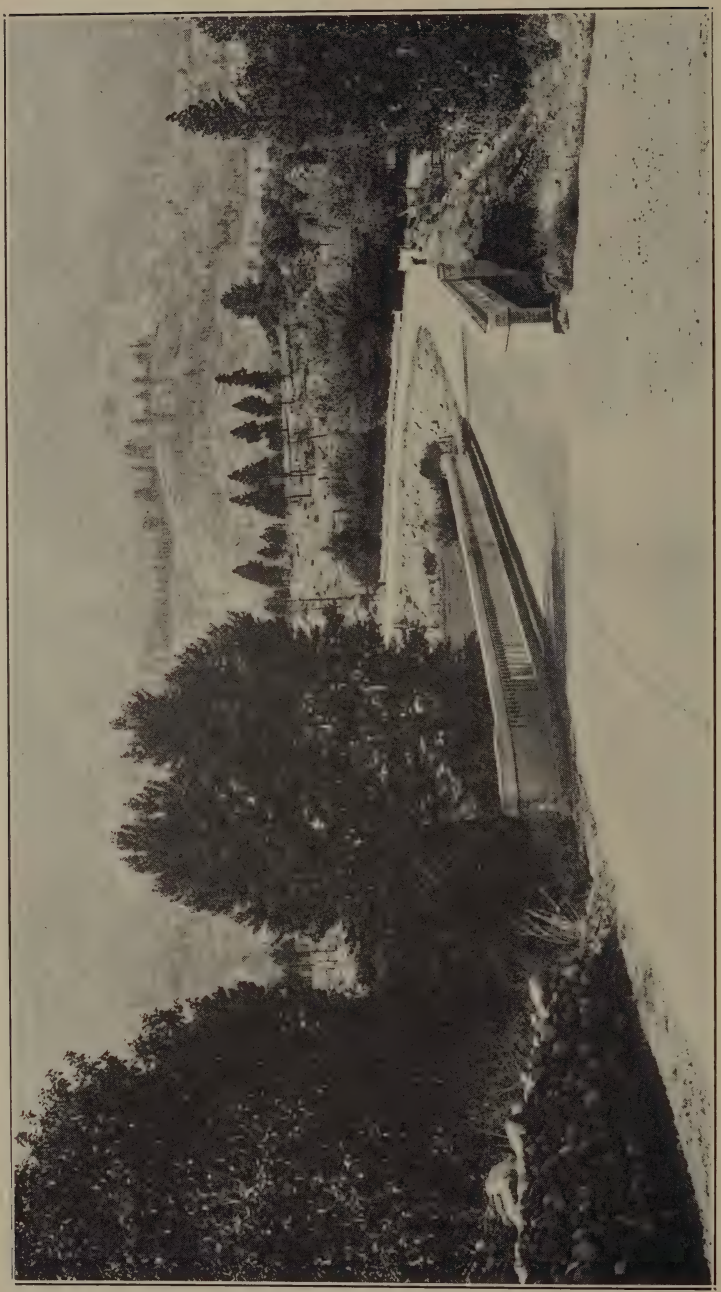
TENTATIVE PROGRAM 1931

The tentative program for 1931 highway construction, as outlined, carries out the Highway Department's policy of giving more consideration to reconstruction of the sections that are rapidly deteriorating than to the construction of new highways. In designating the sections first to be reconstructed, the Highway Department is governed to a great extent by the recommendations of the engineers of the Bureau of Public Roads, as, in order to continue receiving the benefits accruing from the Federal Aid Road Act, the State must maintain its Federal aid highways to a standard set by the Government. Due to the increase in travel each year over certain portions of the highway system, these sections are going to pieces so fast that it is impossible to maintain them to the proper standard, which, of course, forces reconstruction.

The following table gives the proposed 1931 highway construction, reconstruction, and oiling program by routes:

Description	Miles new construction	Miles reconstruction	Miles oil treatment
ROUTE NO. 1			
Four miles east of Silver Zone to Wendover	.....	16.86	16.86
Deeth to Wells	9.65	8.16	
Elko to Deeth	.....	.....	31.44
Battle Mountain to 2 miles east of Dunphy	.....	26.64	26.64
Winnemucca to 6½ miles west of Stone House	.....	27.33	27.33
Overhead grade separation structure at Woolsey—including approaches	0.29		
ROUTE NO. 2			
Five miles south of Fallon to Salt Wells	.....	10.15	10.15
Robinson Summit to Keystone	.....	.....	12.16
ROUTE NO. 3			
Huffakers to Washoe Summit	.....	9.00	
Five miles east of Holbrook to 2 miles north of Carters	.....	15.02	15.02
Dutch Creek to Schurz	22.23		
ROUTE NO. 5			
Las Vegas to Boulder Dam Townsite	25.00		
ROUTE NO. 6			
West slope Mormon Mesa to Lower Virgin River bridge	.....	19.89	19.89
Jean to State Line	.....	.....	12.62
Upper Virgin River bridge			
ROUTE NO. 13			
Thousand Springs Creek to Contact	20.00		
ROUTE NO. 24			
South Elko County line to Wendover	.....	.....	53.52
Totals	77.17	133.05	225.63

In reconstructing the nine-mile section of highway between Huffakers and Washoe Summit on Route 3 it is proposed to widen the roadbed to 28 feet in cut and 30 feet in fill, and the paved surface to



REINFORCED CONCRETE BRIDGE OVER TRUCKEE RIVER IN WASHOE COUNTY.

20 feet. The road will be relocated in several places to eliminate bad curves and shorten the distance. Asphaltic concrete will be used for widening with a minimum of three inches of this same material placed on top of the existing cement concrete pavement as a wearing surface. It is estimated that the construction will cost $30,000 a mile.

The proposed construction at Walker Lake, between Dutch Creek and Schurz, when completed will afford a vast improvement over the present road as the new highway will be of standard width, gravel surfaced, and all the existing bad curvature will be eliminated.

The two aforementioned projects, together with the Boulder Dam road, will constitute the major highway improvements for 1931.

TABLE NO. 4

Miles Completed and under Contract

Type of construction	Miles completed 1917-1928	Miles completed 1929-1930	Miles completed to date	Miles under construction	Total miles
Grading only	240.18	12.36	250.45	2.88	253.33
Grading and crushed rock or crushed gravel	1,063.12	234.35	917.76	47.54	965.30
Grading and asphalt macadam surface	20.56	----------	20.56	----------	20.56
Grading and asphaltic concrete surface	1.96	----------	1.96	----------	1.96
Grading and cement concrete surface	50.99	----------	50.99	----------	50.99
Bituminous treated surface (mixed method)	121.66	380.19	501.47	11.65	513.12
Reconstruction	--- ------	*354.40			
Gravel surface projects previously graded	----------	†2.09			
Totals	1,498.47	983.39	1,743.19	62.07	1,805.26

*This mileage does not change mileage of "Grading and Crushed Gravel" under column "Miles Completed to Date."

†This mileage is included in "Grading and Crushed Gravel" under column "Miles Completed to Date" and miles "Grading Only" reduced to correspond.

Miles of "Bituminous Treated Surface" reduce the mileage of "Grading and Crushed Gravel" by a corresponding amount. 0.38 mile reconstructed which does not change total completed to date.

Summary—Construction Completed 1929-1930

	Grading only	Grading and gravel	Gravel only	Reconstruction	Oiling
Performed by contract	----------	209.51	----------	325.80	378.17
Forest highway work	12.36	4.39	2.09		
Day labor	----------	20.45	----------	28.60	2.02
Totals	12.36	234.35	2.09	354.40	380.19

TABLE NO. 5

Showing Mileage Completed, Under Construction, and Unimproved on the Federal Aid Highway System, State Highways Not on Federal Aid Highway System, and Entire State Highway System, December 1, 1928

Counties	Federal Aid System			State Highways Not on Federal Aid System			Entire State Highway System		
	Completed and under construction	Unimproved	Totals	Completed and under construction	Unimproved	Totals	Completed and under construction	Unimproved	Totals
Churchill	114.74		114.74		97.69	97.69	114.74	97.69	212.43
Clark	109.89	19.41	129.30	49.90	153.25	203.15	159.79	172.66	332.45
Douglas	46.01	10.31	56.32		18.00	18.00	46.01	28.31	74.32
Elko	140.31	125.09	265.40		240.00	240.00	140.31	365.09	505.40
Esmeralda	77.91	42.00	119.91		29.06	29.06	77.91	71.06	148.97
Eureka	72.70		72.70		125.00	125.00	72.70	125.00	197.70
Humboldt	84.69		84.69		171.73	171.73	84.69	171.73	256.42
Lander	109.90		109.90	13.60	192.50	206.10	123.50	192.50	316.00
Lincoln	54.36		54.36	[d]25.31	77.82	103.13	79.67	77.82	157.49
Lyon	68.52		68.52		88.86	88.86	68.52	88.86	157.38
Mineral	[a]82.89	12.80	95.69	6.00	80.20	86.20	88.89	93.00	181.89
Nye	[b]1.55	1.33	2.88	146.44	285.84	432.28	147.99	287.17	435.16
Ormsby	15.01	6.00	21.01				15.01	6.00	21.01
Pershing	74.90	1.22	76.12				74.90	1.22	76.12
Storey	5.40		5.40	1.14	2.74	3.88	6.54	2.74	9.28
Washoe	90.79	6.60	97.39		35.00	35.00	90.79	41.60	132.39
White Pine	[c]159.16	30.66	189.82	10.58	138.68	149.26	169.74	169.34	339.08
Totals	1,308.73	255.42	1,564.15	252.97	1,736.37	1,989.34	1,561.70	1,991.79	3,553.49

[a]24.50 miles between Schurz and Hawthorne constructed by State and Mineral County without Federal aid.
[b]1.55 miles through the Tonopah townsite constructed by Nye County and city of Tonopah without Federal aid.
[c]7.01 miles McGill north constructed by State and White Pine County without Federal aid.
[d]25.31 miles between Caliente and Pioche, Lincoln County, not on Federal Aid Highway System, but was constructed with Federal aid funds made available prior to Federal Aid Highway Act of 1921.
The mileage constructed by State and county without Federal participation must be improved to higher standard to meet Federal aid requirements.

TABLE NO. 6

Showing Mileage Completed, Under Construction, and Unimproved on the Federal Aid Highway System, State Highways Not on Federal Aid Highway System, and Entire State Highway System, December 1, 1930

Counties	Federal Aid System			State Highways Not on Federal Aid System			Entire State Highway System		
	Completed and under construction	Unimproved	Totals	Completed and under construction	Unimproved	Totals	Completed and under construction	Unimproved	Totals
Churchill	114.65		114.65	17.68	81.01	98.69	132.33	81.01	213.34
Clark	129.40		129.40	53.55	160.30	213.85	182.95	160.30	343.25
Douglas	49.88	6.40	56.28	3.40	13.00	16.40	53.28	19.40	72.68
Elko	214.38	42.40	256.78		263.72	263.72	214.38	306.12	520.50
Esmeralda	78.36	41.55	119.91	5.98	17.37	23.35	84.34	58.92	143.26
Eureka	72.67		72.67		124.00	124.00	72.67	124.00	196.67
Humboldt	84.54		84.54	18.74	200.13	218.87	103.28	200.13	303.41
Lander	108.44		108.44	13.60	162.50	176.10	122.04	162.50	284.54
Lincoln	54.31		54.31	46.37	143.29	189.66	100.68	143.29	243.97
Lyon	67.77		67.77	39.44	72.55	111.99	107.21	72.55	179.76
Mineral	93.60		93.60	13.50	85.67	99.17	107.10	85.67	192.77
Nye	2.88		2.88	246.89	253.50	500.39	249.77	253.50	503.27
Ormsby	20.63		20.63				20.63		20.63
Pershing	74.99		74.99				74.99		74.99
Storey	5.40		5.40	1.14	2.74	3.88	6.54	2.74	9.28
Washoe	90.69	6.60	97.29		35.00	35.00	90.69	41.60	132.29
White Pine	170.53	23.57	194.10	20.00	125.29	145.29	190.53	148.86	339.39
Totals	1,433.12	120.52	1,553.64	480.29	1,740.07	2,220.36	1,913.41	1,860.59	3,774.00

NOTE—Total miles completed and under construction entire State Highway System as shown in this table exceeds total mileage completed and under construction shown in Table No. 4 by 108.15 miles. This is mileage improved under maintenance and must be later constructed to a higher standard to meet State and Federal requirements.

FOREST HIGHWAYS

The National Forest Reserves in Nevada are known as the Tahoe, Mono, Toiyabe, Nevada and Humboldt National Forests. Within these reserves, or as connections, there are 460 miles of road designated as the National Forest Highway System, of which 296 miles are a part of the State Highway System and 122 miles are on the Federal Aid System.

During 1929 and 1930 the Bureau of Public Roads, using Forest Highway funds, completed or placed under contract 21.71 miles of highway located and classified as follows:

	Miles
Spooners to 1 mile southeast of Incline, graded and drained	10.00
Calneva to 2.36 miles southeast, graded and drained	2.36
Spooners to Glenbrook, graded and graveled	3.07
Glenbrook to Cave Rock, graded and drained	2.88
Junction State Route No. 3 near Mountain House to California state line at Topaz Lake, graded and graveled	3.40

The projects from Glenbrook to Cave Rock and from Spooners to Glenbrook are on State Route No. 3, and are important links in the State Highway System. The project from the junction of State Route No. 3 near Mountain House to the Nevada-California line near Coleville, California, is on State Route No. 19. This road connects with the California Highway System and is a connection of great importance to interstate travel. The Bureau of Public Roads and the State of California are rapidly improving the connecting road in California from the state line to Bridgeport, which may be termed as the direct route to southern California from the northern and western parts of Nevada.

The section completed from the Nevada-California state line around Lake Tahoe towards Incline is not on the State Highway System, nor is the section from Spooners to Incline; nevertheless, the improvement of these two sections will promote travel around the northeastern part of the lake from both States. Moreover, a road of ample width is now provided for travel around the lake as well as for through travel from one State to another.

The following paragraph relative to National Forest Highway improvements is contained in the "Report of the Chief of the Bureau of Public Roads":

> The policy of restricting the greater part of the expenditure to the improvement of the major roads within the forests is in accord with the similar policy which has yielded such satisfactory results in the improvement of the State roads. But even when so restricted the sums available annually for forest road construction do not permit the improvement of the system at a rate consistent with the improvement of the roads outside the forest areas. With less than a third of the system improved to any degree, and much that has been improved in need of further improvement, it will be many years before the entire system can be adequately constructed at the present rate, and meanwhile the inadequacy of the forest roads will be thrown into sharper relief by the rapidly improving condition of the Federal aid and State roads with which they connect.

Under the present circumstances the most that can be done to serve the increasing traffic upon a large portion of the mileage is to keep the roads passable by maintenance, and this will be done. But increased appropriations are urgently needed if the roads through the forest areas are to be prevented from becoming serious obstacles in the path of a rapidly increasing traffic.

FOREST HIGHWAY FUND APPORTIONMENTS TO NEVADA

1922	$55,352
1923	152,632
1924	75,915
1925	75,799
1926	97,249
1927	96,939
1928	96,603
1929	93,867
1930	94,463
1931	187,058
Total	$1,025,877

NATIONAL FOREST HIGHWAY SYSTEM DESIGNATION IN NEVADA

Route No.	Route	Termini	National Forest
1	Lake Tahoe Highway	From point on Brockway Hwy. near Incline south to junction with Fed. Hwy. System	Tahoe.
2	Brockway Highway	Calif.-Nevada State Line near Brockway to Fed. Hwy. System near Huffakers	Tahoe.
3	Lake Tahoe Highway	From Bijou on Calif. State Line through Glenbrook	Tahoe.
4	Carson Canyon Highway	Calif. State Line to junction with Fed. Hwy. System near Gardnerville	Mono.
5	Topaz Lake Highway	Calif. State Line to point on Fed. Hwy. System near Holbrook	Mono.
6	Dalzell Canyon Highway	Calif. State Line northwest to Wellington on Fed. Hwy. System	Mono.
7	Nevada State Rte. No. 2	From point 4 mi. east of Peterson's Ranch via Austin to east line extended northward of Toiyabe National Forest	Toiyabe.
8	Big Smoky Valley Road	From connection on Austin-Eureka Hwy. to southeast bdy. of Toquina Mountain Div. of Toiyabe N. F. via Manhattan	Toiyabe.
9	Manhattan to Belmont	Manhattan to Belmont	Toiyabe.
10	State Route No. 4	West Boundary Monitor Range of Toiyabe N. F. to east of mountains at end of B. P. R. survey	Toiyabe.
12	State Route No. 4	Ely-Tonopah Road from Butlers Ranch to approximately 2 mi. south of White River Bridge	Nevada.
13	State Route No. 4	From Ely southwest to Holt Crk. on Ely-Tonopah Road	Nevada.
14	State Route No. 7	Ely to junction with Spring Valley Road, a short distance east of Shell Creek Range	Nevada.
15	Secret Pass Road	Valley Road paralleling Ruby Mountains to west forks of road on east	Humboldt.

NATIONAL FOREST HIGHWAY SYSTEM DESIGNATION IN NEVADA—*Continued.*

Route No.	Route	Termini	National Forest
16	Charleston-Jarbidge	Charleston to junction with Gold Creek-Jarbidge Road	Humboldt.
17	Elko-Gold Creek	From forks of road on Elko-Gold Creek Road east of south line of Humboldt N. F. to Middle Fork of Dorsey Creek	Humboldt.
18	Owyhee River Highway	West line of Humboldt N. F. southeast to junction with Elko-Gold Creek Road	Humboldt.
20	Lehman Cave Road	One mile southeast of Baker on Ely - Milford Road, thence westerly about 9 mi. including 1 mi. spur	Nevada.

FOREST HIGHWAY BETWEEN SPOONERS AND GLENBROOK. LAKE TAHOE IN THE DISTANCE.

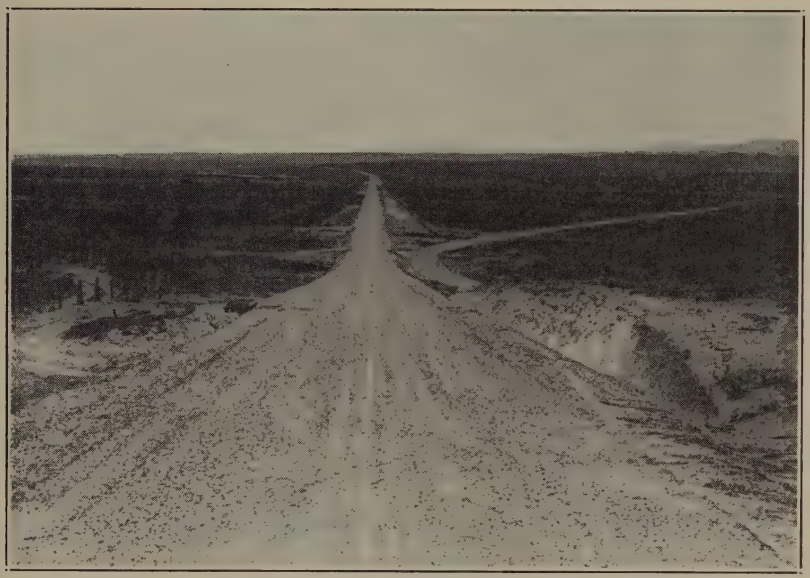
SURVEYS AND PLANS

PRESENT HIGHWAY ALONG WALKER LAKE TO BE RECONSTRUCTED IN 1931.

SURVEYS AND PLANS

Perceptible decreases in the prices bid for various items of road construction during the last two years have justified a distinctly higher type of design than was formerly used. For the first few years of highway work in Nevada one of the governing factors was the cost of roadway excavation. At that period bids for excavation, where a small amount of loose or solid rock might be encountered, frequently ranged from $1.40 up, and in one case reached $2.42 per cubic yard.

For the first few years of this Department's career only 50 per cent of Highway construction, up to $40,000 per mile, was cared for by means of Federal aid, and at the same time sources of supply from



RECONSTRUCTED HIGHWAY BETWEEN ELKO AND HALLECK. HIGHWAY RELOCATED SHORTENING DISTANCE APPROXIMATELY ONE-HALF MILE. OLD ROAD SHOWN ON RIGHT.

which to meet Federal aid were extremely limited. Under these conditions, and with high excavation costs, it became necessary to locate for proposed construction where the least amount of excavation would be encountered. By careful selection of routes and locations it was possible to add additional curvature, and in consequence thereof an increase in length, but at the same time secure an alignment over which construction costs would be considerably less than by a shorter and more direct route.

Each year there have been rapid advances in the design of road machinery. Operators have become more efficient, and competition has become so keen among contractors that bid prices on all items of road construction have steadily dropped. The two most important items in Nevada road building, namely, excavation and crushed gravel,

have taken the greatest drop and have eventually placed construction on a different basis from that which obtained for a few years.

While the prices for excavation during the last two years have been only slightly lower than for the two preceding, the cost of crushing and placing gravel on the roadway has dropped considerably. Even considering the increased amount of gravel now being placed, the average cost per mile for gravel surface placed in 1929–1930 is less by about 20 per cent than for 1927–1928.

Following is a comparison of averages for the last two biennial periods showing bid prices on excavation and for gravel as well as the cost per mile for each:

1927–1928	Excavation	Crushed gravel
Average bid price per cubic yard	$0.365	$1.252
Average cost per mile	2,013.55	2,113.80
1929–1930		
Average bid price per cubic yard	0.340	0.908
Average cost per mile	1,424.84	1,675.74

In 1929–1930 the amount of gravel placed per mile averaged 153 cubic yards more than for the previous two-year period.

During the past two years reconstruction, and resurveys for such, have been carried on to quite an extent. Roads which were built between the years 1918–1924 now require widening and resurfacing, most of these being oiled the same year. With such reasonable prices as are now being secured for excavation, drastic changes in alignment have been warranted in several cases. Two notable examples of such realignment are between the present grade crossing east of Lovelock and Humboldt House in Pershing County, and between Elko and the North Fork of the Humboldt River near Halleck, in Elko County. The reduction in both the length and curvature is given for each of the two sections in the following table, with the Pershing County section represented by No. 1 and that in Elko County by No. 2:

	Original length	Revised length	Orig. curvature	Revised curvature
(1)	22.739	21.803	956°–36′	151°–07′
(2)	8.627	8.281	466°–09′	44°–52′

On the section east of Lovelock the mileage in question originally contained 43 curves while the present alignment has but six. The Elko line change reduced the number of curves to two, whereas there were 17 in the originally constructed line.

In addition to these two mentioned cases there are numerous places where minor changes have been made eliminating a few curves, many of which have in the past been the scene of accident. By dint of straightening the highway where feasible the danger hazard is greatly decreased, the distance between towns shortened and the mileage of highway to be maintained lessened appreciably.

Not only has an attempt been made to decrease the curvature when reconstructing some of the older roads, but when surveying for new construction the same type of location, in keeping with present construction and maintenance costs, is now being adhered to.

In anticipation of the preparation of plans for one year's construction program two survey parties are kept busy throughout the year. Under ordinary conditions a survey party will average slightly more than one-half mile of completed survey per working day. This depends to a great extent upon the nature and topography of the country,

varying from alignment through city streets or towns to the other extreme of flat, open, desert land. Considerable variation is also found between the rate of survey over previously constructed roads and that for new location.

Due to the increased Federal aid appropriation made in 1930 one additional survey party was retained for a portion of the time, this crew being formed from an engineering party on construction. The total miles surveyed for the past two years, as a consequence thereof, exceeded the previous biennium by about forty miles.

Table No. 7 shows the miles of surveys made for the years 1927–1928 and for 1929–1930. In these tables no attempt is being made to segregate the surveys into heavier or lighter construction, but they are shown separately for surveys on new location and those for reconstruction. The surveys are further subdivided into the mileage for each county.

It is to be noted that the surveys are well-distributed over the State, only Humboldt and Storey Counties showing no mileage for 1929–1930. The entire State Highway System within Storey County had previously been surveyed, and a survey is now under way in Humboldt County for reconstructing between Winnemucca and about twelve miles east of Golconda, a distance of approximately twenty-eight miles.

TABLE NO. 7

Surveys Completed

County	1927–1928		1929–1930	
	New construction	Reconstruction	New construction	Reconstruction
Churchill	30.90	17.99	.....	9.99
Clark	41.66	.....	40.86	39.95
Douglas	18.08	2.83	2.14	20.65
Elko	176.84	27.72	94.00	50.46
Esmeralda	20.20	.....	7.91	
Eureka	.....	.....	.....	28.74
Humboldt	.....	30.30		
Lander	.....	8.52	49.14	20.60
Lincoln	35.47	.....	86.16	
Lyon	20.65	.....	22.47	30.43
Mineral	49.18	.....	30.01	10.62
Nye	25.41	.....	49.71	
Ormsby	10.51	.....	5.66	
Pershing	17.15	22.00	.....	16.68
Storey	.....	.....	.....	.....
Washoe	.....	3.81	5.85	11.83
White Pine	50.31	.....	.....	12.26
Totals	496.36	113.17	393.91	252.21

In the foregoing tables for 1929–1930 the miles of surveys as listed include only the adopted mileage. In many instances it is and has been necessary to run alternate lines over certain stretches of road in order to determine by means of estimates the most feasible and economical. For 1928 and 1929 the total mileage surveyed, alternate lines as well as adopted lines, was included in the table of miles of surveys. It is now considered more applicable to include only the mileage over which construction is contemplated; and as a consequence, for a favorable comparison of the total surveys during the past biennium with those made during the previous two years, a total of 124.14 miles should be added. This figure represents alternate or rejected surveys for the last two years.

The same feature applies to the cost per mile of surveys as the above-mentioned 124.14 miles were not included in estimating the cost per mile for 1929–1930.

The following table shows the cost per mile for making surveys:

	1927–1928		1929–1930	
	Miles	Cost per mile	Miles	Cost per mile
New construction	496.36	$99.45	393.91	$125.03
Reconstruction	113.17	68.38	252.21	112.26

In keeping with the higher standard of highway location established during the last few years, the design of type of roadway for construction has also been raised.

Standard widths of roadway on which Federal aid was received were formerly 20 and 21 feet from shoulder to shoulder. In cases where cuts were encountered, small ditches, if any, were constructed outside the ordained roadway width. Larger ditches would have mate-

VICTORY HIGHWAY OVER EMIGRANT PASS.

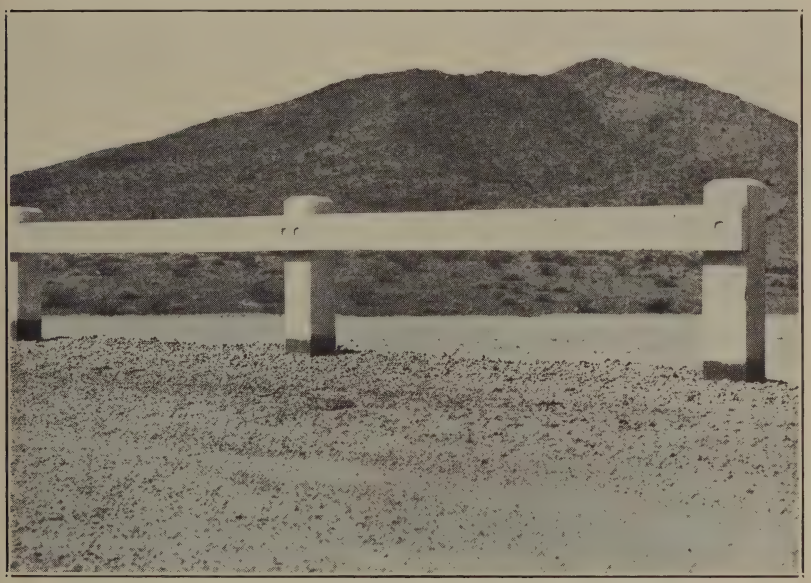
rially increased the amount of earthwork and for many years earthwork was extremely costly.

Gravel surfacing was placed sparingly and where the roadway fell in gravelly formation the surfacing was often omitted. Data given earlier fully explain the reason why careful consideration was required at that time. With a long haul from gravel deposits the final cost of surfacing in place on the road frequently reached as high as $3.50 per cubic yard. As a consequence, however, of small depth of surfacing placed on heavily traveled highways, maintenance costs became excessive, and eventually reconstruction became a necessity on those which had received the heaviest travel.

The present standard of design of roadway is, of course, elastic to some degree and must be adapted to the particular road in question. The design most frequently used, and now taken as a minimum with

Federal aid, consists of a roadway 24 feet from shoulder to shoulder. adequate ditch slopes outside the prescribed shoulder width in cut and also in fill, a surface width of 18 feet, the depth of surfacing compacting to six inches. Where oiling is included it is attempted to oil a gravel depth of not less than three inches in the center of the roadway and four inches at the edge of gravel.

The advent of lower construction costs has enabled this Department to design a more uniform grade line with fewer vertical curves, and these of a much flatter radius than formerly. The vertical sight distance now developed is ample to provide safety in practically all cases for driving at the designated speed of 50 miles per hour. Cases arise where horizontal curvature prevents the maximum of speed with safety, but the curves are being flattened to the maximum practicable and are

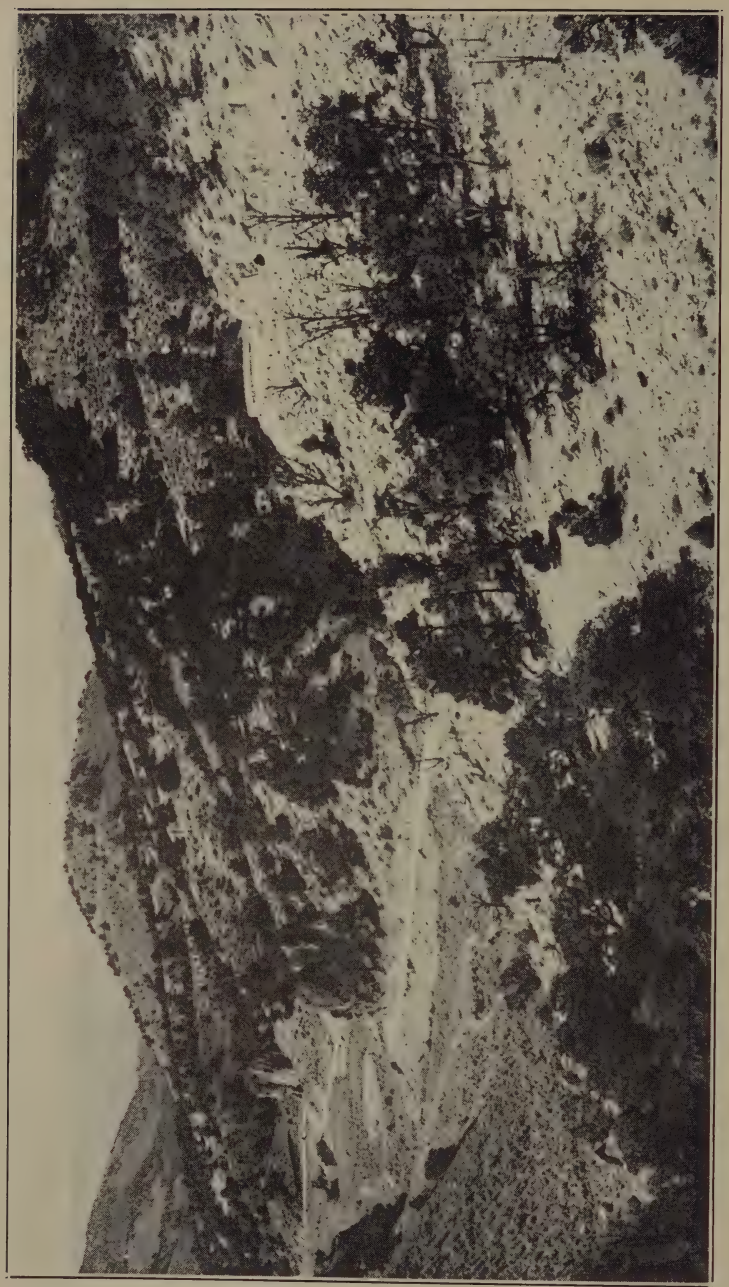


SECTION OF STANDARD TIMBER GUARD RAIL.

further augmented by the superelevating of all curves of 5,000-foot radius or less.

A superelevation of one and one-half inches per foot width of roadway is considered the maximum which can safely be constructed in sections subject to snow and freezing. Slow moving cars on highly superelevated curves are apt to slide where the roadway is icy. This safe maximum of one and one-half inches per foot width of roadway is prescribed for sharp, or short radius, curves, decreasing as the sharpness of the curve decreases.

Right of way widths were formerly 50 and 60 feet, especially through cultivated sections of land. Narrow widths necessitated the construction of deep borrow ditches immediately off the shoulder of the roadway. These deep ditches were not only unsightly and difficult to maintain but were a most serious danger hazard causing frequent accidents. In reconstructing projects of this type more right of way is



LINCOLN HIGHWAY LOOKING WEST FROM CARROLL SUMMIT, CHURCHILL COUNTY.

being secured on each side, wherever it is possible, and the unsightly ditches filled with material secured from the new strip of right of way.

The newly finished roadway now has flattened slopes, where fills are not too high to prevent, and has the required section of drainage ditch some fifteen feet or more from the roadway shoulder. The slopes to the ditches are sufficiently flat, where possible, to allow driving thereon should the necessity arise.

Since the flattening of side slopes on higher fills is not justified, due to the enormous amount of embankment required, compensation is usually made by allowing a slight increase in width. The usual increase in high fills is one foot for each shoulder, and where considered necessary the addition of guard rail is required as a further precaution.

Widths of surfacing on roads constructed during the first few years of the Highway Department varied from ten feet up to fifteen. As mentioned previously the excessive cost of crushed gravel was one of the features preventing the use of more than the minimum. At the present time, however, the width of surfacing is rarely less than eighteen feet and through towns is often increased up to twenty or more. An eighteen-foot surface width permits the passage of two cars with four feet clearance between cars and approximately one and one-half feet of surfacing outside the outer wheels. This amount of safety is deemed advisable due to the glare of headlights at night and the slight tendency toward skidding if the gravel is not fully compacted.

During 1929 and 1930 plans were prepared for the advertising and constructing of 567.75 miles of roadway. This is an increase of 153.85 miles over the preceding two-year period and was necessitated by the increased Federal aid made available during 1930. As shown by accompanying tables the greater portion of this increase in mileage was taken up by reconstruction.

The total mileage of plans prepared during each of the last two biennia is shown in the following table. The plans for new construction and for reconstruction are shown separately and are further divided into counties:

TABLE NO. 8

Plans Completed

	1927–1928		1929–1930	
County	New construction	Reconstruction	New construction	Reconstruction
Churchill	230.25	19.27	13.64	9.99
Clark	8.66	28.15	23.69	62.59
Douglas	15.61	3.65	.....	3.44
Elko	.....	25.82	76.60	58.48
Esmeralda	52.87	.....	5.98	32.54
Eureka	.....	.....	.....	11.65
Humboldt	.....	17.41	18.60	13.62
Lander	.....	8.52	10.95	0.75
Lincoln	15.74	1.70	.....	19.94
Lyon	33.09	.....	39.43	19.73
Mineral	55.19	.....	21.15	
Nye	0.64	.....	30.08	
Ormsby	10.51	.....	5.66	
Pershing	16.73	16.72	.....	56.88
Storey	.....	.....	.....	.....
Washoe	.....	3.81	.....	2.54
White Pine	39.71	16.85	17.56	12.26
Totals	272.00	141.90	263.34	304.41

The mileages shown for the biennium 1929–1930 in Table No. 8 include only the adopted lengths of projects, whereas for the preceding biennium the alternate lines were included.

The following table shows the cost per mile for preparing plans:

	1927–1928		1929–1930	
	Miles	Cost per mile	Miles	Cost per mile
New construction	272.00	$111.99	263.34	$121.74
Reconstruction	141.90	60.00	304.41	109.36

The foregoing table, as in the case of surveys, segregates the plans into new construction and reconstruction. By comparison it is readily seen that there is very little difference in the amount of work required for preparing plans for reconstruction and those for new work.

HIGHWAY RIGHT OF WAY

Before Federal aid funds can be secured for construction purposes, it is necessary for the State to have clear title to the right of way along

CITY OF TONOPAH—MAIN STREET OIL TREATED FULL WIDTH.

the route of proposed improvement. During the course of highway improvement in Nevada the Department of Highways has acquired for the State 17,857.85 acres of land for highway right of way. This land is divided into two classes, namely, privately owned land, and Government land. To date 7,352.11 acres of privately owned land have been purchased for a total cost of $110,343.54, or at the rate of $15.01 an acre; and 10,535.74 acres of Government land have been secured without cost. The Department has also acquired right of way for certain sections of the Nevada Forest Highway System in the Tahoe National Forest not on the State Highway System.

During this biennium 1,022.32 acres of privately owned land were

purchased at an average cost of $7.08 an acre, and 2,277.95 acres of Government land were secured.

During the past two years, in straightening many miles of alignment, the Department has been under heavy expense in securing rights of way, due principally to the higher types of land traversed. In the majority of cases the securing of rights of way over reconstructed projects was more difficult and costly than that over unimproved sections.

The Highway Department now makes it a policy to secure a minimum width of right of way of 100 feet, except through highly cultivated areas, where the width is reduced to 80 feet.

With one exception it has not been necessary to exercise the State's right of eminent domain in securing rights of way during the past two years, and in all cases the Department's dealings with property owners have been pleasant and agreeable to both parties.

Table No. 9 sets forth, by routes, the class of acreage owned by the State and the costs involved.

TABLE NO. 9

Total Acres of Land Acquired for Highway Right of Way Prior to December 1, 1928

State Highway routes	Through privately owned land	Through Government land	Total through private and Government land	Cost through private land	Cost per acre	
					Private land	Total
1	2,043.13	1,705.92	3,749.05	$54,449.15	$26.65	$14.52
2	237.52	2,578.56	2,816.08	9,855.10	41.49	3.50
3	745.68	1,462.48	2,178.16	24,916.85	33.41	11.44
4	42.08		42.08			
5	2,780.00		2,780.00	3,829.44	1.38	
6	178.92	954.54	1,133.46	3,713.05	20.75	3.28
7	91.72	1,022.01	1,113.73	4,340.00	47.32	3.90
8	121.17	122.61	243.78	171.00	1.41	.70
9	89.57	22.34	111.91	1,831.00	20.44	16.36
17		52.36	52.36			
24		336.97	336.97			
Subtotal	6,329.79	8,257.79	14,557.58	$103,105.59	$16.29	$7.08

Total Acres of Land Acquired for Highway Right of Way from December 1, 1928, to December 1, 1930

State Highway routes	Through privately owned land	Through Government land	Total through private and Government land	Cost through private land	Cost per acre	
					Private land	Total
1	403.53	183.40	586.93	$155.75	$0.39	$0.27
1A	22.84	187.44	210.28			
1B	131.91	134.90	266.81	1,834.70	13.91	6.88
2	46.63	93.06	139.69	750.00	16.08	5.37
2A	36.61	52.15	88.76	400.00	10.93	4.51
2B	20.33	102.62	122.95	210.00	10.33	1.71
3	188.62	61.54	250.16	3,887.50	20.61	15.54
5		411.03	411.03			
6	7.52	158.39	165.91			
8	29.09	196.36	225.45			
13	108.13	173.39	281.52			
19	23.14	9.83	32.97			
24	3.97	513.84	517.81			
Subtotal	1,022.32	2,277.95	3,300.27	$7,237.95	$7.08	$2.19

SUMMARY

State Highway routes	Through privately owned land	Through Government land	Total through private and Government land	Cost through private land	Cost per acre	
					Private land	Total
Totals prior to December 1, 1928	6,329.79	8,257.79	14,557.58	$103,105.59	$16.29	$7.08
Totals December 1, 1928 to December 1, 1930	1,022.32	2,277.95	3,300.27	7,237.95	7.08	2.19
Totals	7,352.11	10,535.74	17,857.85	$110,343.54	$15.01	$6.18

BRIDGE DEPARTMENT

REINFORCED CONCRETE BRIDGE IN LYON COUNTY.

BRIDGE DEPARTMENT

Standardization of specifications for the design of steel and concrete bridges has progressed rapidly during the past few years. In cooperation with the United States Bureau of Public Roads, the American Association of State Highway Officials has issued two standards, the first covering the design and specification for steel, concrete and timber bridges, and the second relating to the design of steel bridges only. This latter has also been adopted as a standard by the American Railway Engineering Association.

This does not mean the standardization of individual design, but merely an effort to produce a uniformity in the data, formulas and specifications used. While the standards have not been officially

WELL DRILLING OUTFIT MAKING TESTS TO DETERMINE CHARACTER OF FOUNDATION FOR NEW BRIDGE.

adopted by the Nevada State Highway Department, they are, with slight modification to adapt them to specific conditions within the State, used as a basis for design.

Loadings used in the design of all structures have been, in this State, divided into two classes: Class "A" for main traveled highways and Class "C" for secondary roads.

Class "A" loading is for bridges supporting normally heavy highway units with occasionally very heavy loads. It is equivalent to a string of 15-ton trucks occupying each 9-foot traffic lane.

Class "C" loading is for bridges of a temporary or semitemporary nature supporting light highway traffic units. It is equivalent to a string of 10-ton trucks occupying each 9-foot traffic lane.

No two bridge sites are identical in all features, hence it has proved uneconomical to use a standard design for all structures. The main characteristics governing the determination of each bridge are its location, span, foundation and local materials available.

The location of a bridge no longer governs the location of the highway, but has been made subsidiary to it in order to produce an easy alignment with as few curves as possible. Many of our older structures were built with the idea of securing the shortest possible bridge at right angles to the stream, in many cases causing bad curves on either end, which have been a source of danger.

Character of foundation may govern entirely the type of bridge most suitable and economical. Good bearing secured at reasonable depth requires very different treatment from the case where deep

TYPICAL OVERHEAD GRADE SEPARATION STRUCTURE.

quicksand is encountered. This will affect both the design of piers and superstructures.

The availability of local materials will also control the type of construction selected. Good sand and gravel in sufficient quantity near the bridge site may cause a design in reinforced concrete to be more economical, while lack of such material may cause the selection of a steel structure.

Practically all structures now being built or planned by the department involve the more permanent types of construction, either steel or reinforced concrete, or a combination of the two materials.

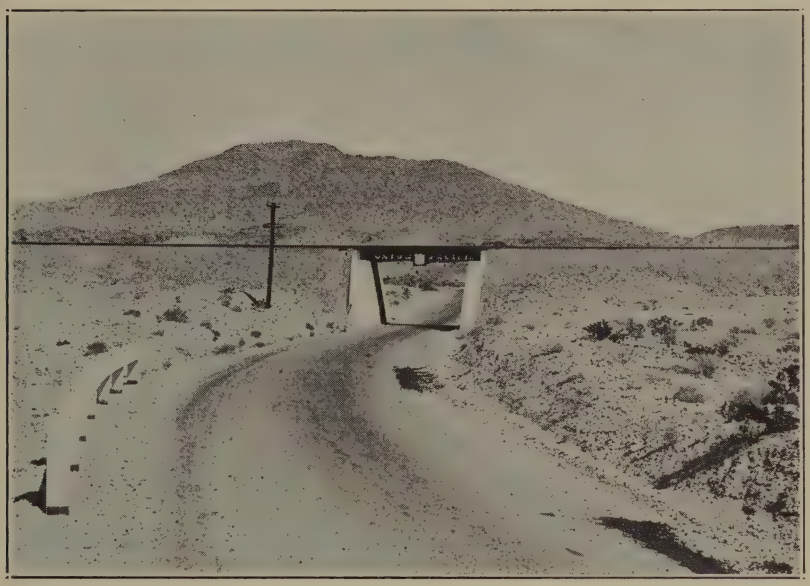
Economical design and construction of bridges require much attention to detail and a very thorough study of all conditions involved. In general, the method followed involves the following procedure:

Having determined the necessity for a structure, a location party

carefully studies the ground to find the location most suitable for the crossing and for the roadway approaches to it, selecting that which offers the shortest structure while maintaining an alignment free from dangerous curves and a profile that is easy riding and gives a maximum view of approaching traffic. At times it is necessary to run two or three lines before the best can be selected for the final location.

After the location has been decided, a complete study of the bridge is made in the field to select the span length and height necessary to provide the required clearance or waterway. Test pits are dug, or wash borings made, to ascertain the character of the foundation material which will be encountered and the depth to which footings must extend in order to be free from external influence and capable of safely carrying the loads imposed.

Finally, a detailed study is made of local materials suitable for the



TYPICAL UNDERPASS GRADE SEPARATION STRUCTURE.

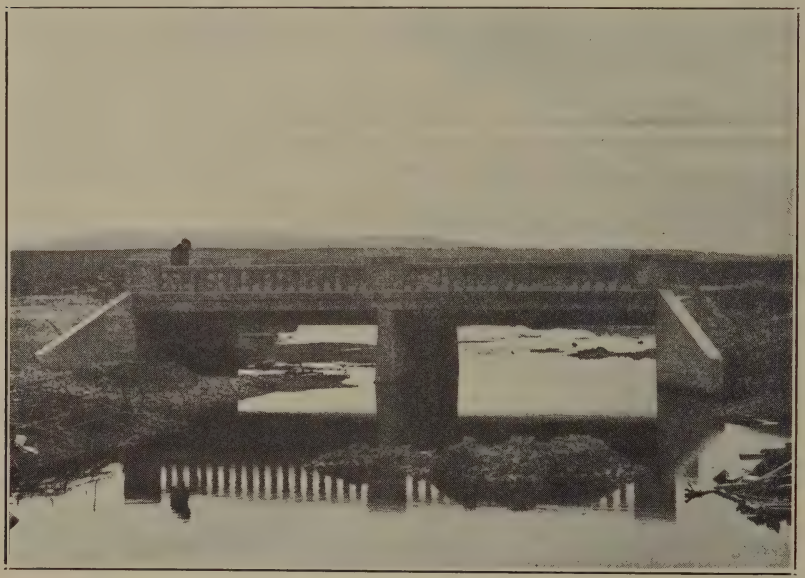
construction work involved. Prospect holes are sunk to open deposits of sand and gravel for concrete, and samples are taken for testing in the department's laboratory to make certain that the pits will produce aggregates sufficiently strong to withstand the stresses to which they will be subjected. The quality and quantity of water available, the cost of materials manufactured locally, the nearest shipping point, the character of roads over which materials not obtainable locally must be hauled, and the kind and amount of labor available are also determined. Studies of the kind and amount of traffic and its probable volume during the life of the structure are also made.

With this information, actual plans are started. Usually, preliminary estimates of cost are made for two or more types of construction and the cheapest selected for the final design. Entering into the final

selection of type is also the question of future maintenance costs. The cheapest type for original construction may prove the most costly when calculated over a period of years equivalent to its useful life.

The final design is carefully worked out, each part being made of ample size to carry the loads to which it may be subjected, but always with the idea of securing that strength with the minimum possible cost. After completion, the design is completely checked to eliminate possible errors. Estimates of quantities of the various materials involved are made, and specifications are written to cover the character and quality of materials and workmanship which shall enter into the bridge.

Invitations for bids are issued to contractors, and the contract for construction is awarded to the lowest bidder. An experienced engineer is placed in charge of the project to see that all work is done in a satisfactory manner and that all materials used are of the kind and



REINFORCED CONCRETE BRIDGE IN ELKO COUNTY.

quality specified. All materials entering into the completed work are tested before being used. It is largely the capability and care of the engineers and inspectors in charge of bridge projects that have produced the excellent work that the department has been able to secure.

BRIDGE PROJECTS

During the years 1929–1930 the following bridge projects have been completed or are under construction:

East Walker River Bridge—Lyon County, Route 3, 8 miles south of Yerington. Reinforced concrete girder type with 65-foot span, replacing old county steel bridge wrecked by overloading. Completed November, 1930.

Truckee Canal Bridge—Lyon County, Route 1–B, 1 mile south of Fernley. Low steel truss type with concrete floor, 59-foot span. Completed September, 1930.

North Fork Bridge—Elko County, Route 1, over north fork of Humboldt River, 16 miles east of Elko. Concrete and steel girder type with 44-foot span, replacing old county bridge. Completed October, 1930.

Thousand Springs Creek Bridge—Elko County, Route 13, 25 miles north of Wells. Reinforced concrete girder type with 35-foot span. Under construction.

Indian Reservation Bridge—Mineral County, Route 1–A, over Walker River near Schurz. High type timber trestle with 97-foot span. Under construction cooperating with U. S. Indian Service.

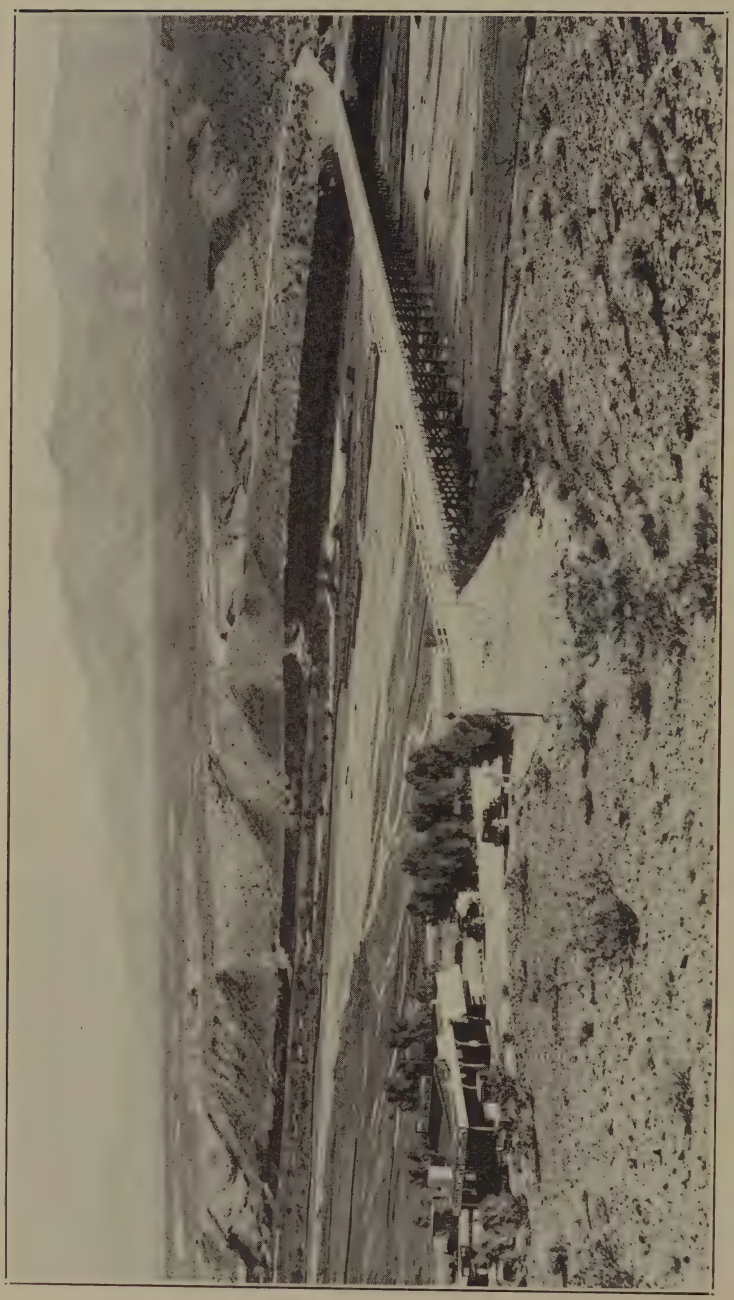
In addition to the design of larger bridges, numerous plans have been prepared for smaller structures, such as the enlargement of existing culverts, culverts under unusual conditions requiring special design, cattle guards, cattle passes and flumes.

DAMAGE TO TIMBER TRESTLE OCCASIONED BY CLOUDBURSTS.

For the ordinary culvert, under which classification all bridges of less than 20-foot clear span fall, the standard plans have been revised and complete new standard designs issued.

Designs were also prepared for the enlargement of the machine shops of the Reno Equipment Yard and for maintenance houses to be used for maintenance crews on remote patrol sections where no living quarters were available.

During the biennium a new system of maintenance inspection has been inaugurated whereby every bridge within the State Highway System is inspected at regular intervals to insure its safety and the



TREATED TIMBER PILE TRESTLE OVER VIRGIN RIVER IN CLARK COUNTY.

safety of the traveling public. Such inspections enable the department to detect at their inception such minor faults as may occur, and to effect immediate repairs, thus reducing the maintenance cost of the bridge and prolonging its useful life. Defects found so far have been readily remedied by routine maintenance work, consisting largely of repairing worn plank flooring for timber deck structures, placing asphalt surfacing on concrete floors and preservative painting of steelwork.

By means of regular inspections it is also possible to carefully watch old structures which have been taken over from the counties and incorporated in the State Highway System, to determine the period of their economic life and the necessity for replacement.

An unusual burden was placed on bridge maintenance funds in the latter part of 1929 when cloudbursts, coupled with the failure of a dam impounding irrigation water, seriously damaged two timber pile bridges on the Virgin River in Clark County. The flood waters washed out numerous piles in both bridges, necessitating the replacement of the piling under difficult conditions.

Fortunately, the department was able to maintain traffic with but slight delay. Traffic was allowed on one bridge at all times, but on the second, due to the collapse of a portion of the deck, travel was held up during the period of high water. As soon as the flood had receded, teams were secured and traffic towed across the river until permanent repairs could be completed.

A complete investigation has been made covering the location, materials and conditions affecting design for a new bridge to replace a timber pile trestle over the Virgin River, near Mesquite, in Clark County. The present structure consists of pile bent approaches flanking two central steel truss spans, the over-all length being 957 feet. Decay in the untreated piling, together with a narrow roadway and mounting maintenance costs, shows that this structure has reached the limit of its economic usefulness. This is the largest bridge within the State and it is proposed to replace it with a permanent type of construction during the coming biennium.

Grade crossings of highways and railroads have always been a source of serious accidents to the motoring public and it has been the policy of the Department to reduce the number as rapidly as conditions and finances warrant. With the exception of branch lines and railroads operating within the State carrying but few trains each day, the number of such crossings on the three main transcontinental roads, the Lincoln and Victory Highways and the Arrowhead Trail, has been reduced from some fifty or sixty to a total of five. This has been accomplished by relocating lines whenever possible to avoid crossings and by the construction of overhead or underpass structures.

Plans are now complete for the elimination of two of these, leaving but three grade crossings of interstate railroads on the Victory Highway and none on the Lincoln Highway or Arrowhead Trail.

An overhead structure over the Southern Pacific Railroad east of Lovelock, near Woolsey, will eliminate a dangerous crossing which has been the scene of several fatal accidents. A second overhead near Wendover on the Western Pacific Railroad will improve the safety of the Lincoln Highway near its connection with the Victory Highway.

TABLE NO. 10
Bridges of More Than 20-Foot Clear Span

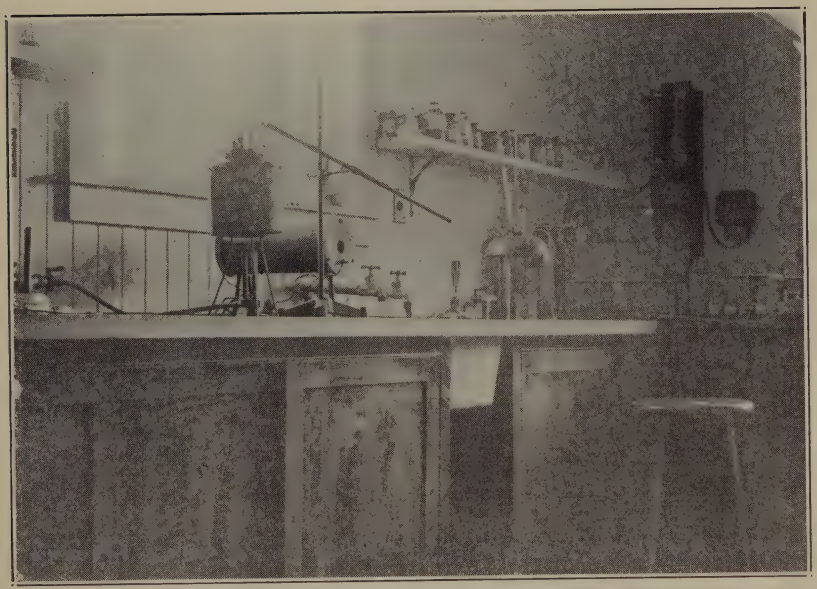
County	Location	Length: Reinforced concrete	Length: Structural steel	Length: Timber bridges and trestles
Churchill	Canal west of Fallon	90		
Churchill	Carson River west of Fallon	162		
Churchill	Canal between Hazen and Leeteville	50		
Churchill	Canal 3 miles south of Fallon	42		
Clark	Virgin River between Bunkerville and Mesquite	.....	252	708
Clark	Muddy River at St. Thomas*	.....	.....	110
Clark	Virgin River 8 miles southwest of Bunkerville	.....	.....	884
Clark	Muddy River near Moapa	.....	.....	144
Douglas	Carson River at Cradlebaugh	200		
Douglas	Slough at Cradlebaugh	74		
Douglas	Dangberg Canal	25		
Elko	East branch of North Fork near Halleck	45		
Elko	Mary's River near Deeth	44		
Elko	Humboldt River near Deeth	.....	75	
Elko	North Fork Humboldt River east of Elko	44		
Elko	Thousand Springs Creek north of Wells†	35		
Eureka	Humboldt River at Dunphy	.....	126	
Lincoln	Meadow Valley Wash at Caliente	.....	.....	74
Lyon	Walker River at Bulkhead	80		
Lyon	Simpson Canal at Wellington	44		
Lyon	East Walker River south of Yerington	65		
Lyon	Truckee Canal near Fernley	.....	59	
Mineral	Walker River at Schurz†	.....	.....	97
Pershing	Humboldt River near Lovelock	144		
Washoe	Evans Creek south of Reno	35		
Washoe	Highland Canal near Mogul	52		
Washoe	Truckee River west of Verdi	193		
Washoe	Truckee River east of Verdi	141		
Washoe	Truckee Canal near Verdi	.....	75	
Washoe	Truckee River at Wadsworth	268		
	Subtotal bridges	1,833	587	2,017
Clark	Overpass near Jean	104		
Clark	Underpass at Apex	58		
Clark	Underpass at Crystal‡	63		
Elko	Overpass west of Wells	.....	.....	90
Elko	Underpass west of Wells	100		
Elko	Overpass near Deeth	130		
Elko	Underpass at Silver Zone	76		
Eureka	Overpass at Dunphy	136		
Humboldt	Overpass at Rose Creek	130		
Humboldt	Underpass at Winnemucca	107		
Lyon	Underpass west of Fernley	112		
Lyon	Overpass east of Fernley	154		
White Pine	Overpass near Ely	73		
	Subtotal grade separations	1,243	.....	90
	Grand totals	3,076	587	2,107

*Abandoned due to change in location of road. †Under construction.
‡Constructed by Union Pacific Railroad.

Summary

Type of construction	Completed 1917–1928		Completed or under construction 1929–1930		Total	
	No.	Length	No.	Length	No.	Length
Reinforced concrete	29	2,932	3	144	32	3,076
Structural steel	4	528	1	59	5	587
Timber bridges and trestles	6	2,010	1	97	7	2,107
Totals	39	5,470	5	300	44	5,770

TESTING DEPARTMENT



VIEW OF INTERIOR OF OIL TESTING LABORATORY.

TESTING DEPARTMENT

The laboratory is a necessity to modern highway construction. Its functions govern the grading and quality of both raw materials and finished products, as well as furnishing means to improve all commodities used.

No longer is quality or durability left to chance. Knowledge of the quality of a road improvement is based on rigid testing of all materials necessary for the work before they are used, and the reliability of this pretesting is further checked by testing the same materials as they are being used. When it is possible to do so, a final check is made by testing the finished product itself.

There was a time when testing was practically unheard of. Even if tests were desired there were no facilities for performing them. Building and manufacturing were based upon authority handed down through the ages. The only measure of reliability depended upon rough selection of the best from generations of trial and error. Improvements in materials came only through infrequent discoveries made by accident or chance.

Times have changed, and in no other period of history has the importance of testing materials been realized as it is today. The manufacturer knows that the quality of his product will be the keynote in selling. To constantly check and improve this quality, he employs a highly trained corps of engineers and assistants, and installs them in a well-equipped laboratory. What he is doing is duplicated in fields outside the realm of commerce, so what is true of manufacturing in general is true of road building. Since the construction of highways has become one of the greatest of modern industries, it follows that adequate means for testing have been developed.

The laboratory must be supplied with standard tests and specifications. In Federal aid construction these requirements are further augmented. The standards of the Federal Government are rigid and must be complied with.

The work of compiling and fixing a set of standards is not left to the States alone. The present degree of uniformity of standards for highway materials has resulted through the combination of agencies such as the Bureau of Standards, the Bureau of Public Roads, the American Society for Testing Materials, and others. However, standards cannot remain fixed, but must be adjusted to meet ever-changing conditions. It is therefore the duty of the Testing Department to keep ever on the alert. In addition to discharging its routine duties according to standards, it must keep stride with the changes, and meet them as they come. Further, it must lend its own voice in the cause of betterment when occasion for such arises.

The testing of road materials in Nevada was commenced early in 1919 coincident with the first construction undertaken by the newly created State Highway Department. Testing was done at first on a small scale, but expansion of construction led to increased requirements. Apparatus was added from time to time and the Testing

Department grew to meet this expansion. The laboratory is at present well equipped to test all road materials used in this State, except reinforcing and structural steel. By special arrangement these tests are made in the laboratory of the University of Nevada.

The growth of the Testing Department has been notable since its beginning, but the past biennium has witnessed expansion which exceeds that of any other period. This has been due especially to the increased use of road oil for treating gravel surface. A comparison of the number of oil samples tested in each of the two last biennial periods serves to illustrate. During the biennium ending in 1928 there were 188 oil samples tested, while during the two years just past the number was 1,020.

Early in 1929 it was realized that in order to meet the outlined oiling program with adequate testing, it would be necessary to expand laboratory facilities.

A section of the stockroom was therefore partitioned and remodeled to fit the requirements of a modern chemical laboratory. This room was then equipped with the necessary laboratory furnishings, and a great part of the work was done by the personnel of the Testing Department. In one corner of the laboratory was built a draft-proof weighing room fitted with a built-in concrete table for the weighing apparatus. The idea of such a device is to eliminate errors due to draft and jarring where delicate weighing is concerned.

The chemical apparatus and supplies, as well as all the movable oil testing equipment on hand, were placed in this new laboratory. New pieces of apparatus for testing oil were installed, the chief of these being a closed cup flash tester, a four-tube Saybolt viscosimeter with electric controls, and an oil still. A special twelve-cup oil evaporator, designed by F. H. Morrison, Testing Engineer, and cast at the local foundry, completed the equipment.

Although these improvements involved a considerable expenditure, they came as a necessity. The matter of expense, however, is more than overcome in the resultant advantages. First, the range of testing is increased; that is, more kinds of tests are possible. Second, the degree of accuracy is improved through more sensitive means of control, thus increasing the reliability of testing. And, finally, there is made possible a greater volume of tests per individual operator, thus saving both time and expense. As an example, it is now possible for a single operator to run from two to three dozen oil samples through the complete category of tests in one week's time, where formerly his maximum output might have been a single dozen.

Special circumstances have directed the trend to improvement, mainly toward oil testing; nevertheless, the mechanical laboratory has not been without its gains. Additions here are a new substantial work bench, a new gas stove, and a hydraulic compression machine.

This hydraulic machine is used to break concrete test cylinders and cylinders made from surfacing material binder. It was installed in November, 1929, at a cost of about seven hundred fifty dollars. Since that time it has more than paid for itself. In order to perform these tests it was formerly necessary to take the samples to the laboratory of the University of Nevada. This entailed loss in both time and money. It was necessary for a man to spend at least one-half a day

to make the trip, to say nothing of the expense incurred in transportation. Besides, these trips were frequent due to the fact that each test cylinder must be broken at the expiration of a definite curing period. It could not always be arranged that a large number would fall due on the same date, thus the average cost to break a single cylinder amounted to more than two dollars. Since the time consumed in the breaking of a cylinder is but a few minutes, it is now possible to save practically this entire amount. Computed on such a basis, the new compression machine, since its installation, has saved approximately one thousand dollars on concrete tests alone.

It therefore may be shown that improvements in equipment mean improvements in efficiency. In the final analysis this means a saving in dollars and cents.

The advantages of this expansion have been pointed out; however, it is not out of place to mention here the attendant disadvantages. The entire headquarters unit of the Nevada State Highway Department is housed on the first floor and in the basement of a single building. The third floor is occupied by the State Engineer and by the local unit of the American Legion. Quarters for the laboratories, the stockroom and files, and the blue print appliances are in the basement.

It has been mentioned that a part of the stockroom was taken over for the construction of a new chemical laboratory. This was done by further crowding already congested quarters. In addition, it has cut down the space allotted for the filing of test samples. Some provision should therefore be made for further expansion. The Testing Department will need more room for growth, and additional space must be available for general office stocks and files.

There is still another unfavorable condition in connection with this peculiar housing situation. Fumes from the heat treatment of oils and certain chemicals often permeate the building in quantities sufficient to cause unpleasantness. This occurs in spite of measures taken for safe removal of such fumes.

The solution for these problems points to the removal of the laboratories to separate quarters. In view of all considerations it would seem sound policy for the State to build, just west of the main building where an excellent site is afforded, a modern one-story structure to house the laboratory.

Now let us consider the nature of the work of the Testing Department. We find its functions in relation to road building are in general very similar to those of any laboratory in relation to its particular industry. Such general functions have already been mentioned. It may be of interest, however, to examine some of the specific duties.

When a project is outlined for construction, to the reconnaissance engineer, or often the testing engineer, is consigned the job of making a materials survey. A comprehensive examination of the district in question is made in a search for convenient sources of natural materials for road building purposes. After the examination is completed, test holes are dug in the deposits that appear to be the most suitable, and average samples of the materials are taken. These samples are sent to the laboratory for analysis. A deposit is acceptable only after the

laboratory tests have proven the materials satisfactory. The kind of natural materials referred to consist of surfacing gravel, concrete gravel and sand, and selected borrow material for fills and selected binder.

Prior to letting contracts for construction, the Testing Department supplies a certain amount of definite information relative to the various materials designated for the work. Reports of tests on all materials to be used are submitted to the Division Engineer, who has direct supervision of the work. If Federal aid funds are involved in the proposed improvement, the Bureau of Public Roads is also furnished with a copy of the test reports.

All manufactured materials, such as reinforcing steel, cement and corrugated metal pipe, must also be tested before using. In the case of corrugated metal pipe, samples are submitted by the manufacturer for testing, and the pipe is not fabricated until samples of the sheet metal have been tested by the department and proved satisfactory as to quality. To guard against error, and to make doubly sure of quality, the material is again tested when the pipe is received.

During the course of construction, tests on all materials are made from time to time in order to check preliminary testing and to insure that they will meet specified requirements. The engineer who has direct charge of construction knows that the testing laboratory is always at his service. If material is encountered that seems inferior, he sends it to the laboratory for analysis. The report is returned to him as soon as possible, and if defects are found, corrective measures are taken.

The kind of testing mentioned constitutes the chief work of the Testing Department. These tests are performed according to definite methods accepted as standard by all leading institutions of testing. There is, nevertheless, another branch of work equally important. It is often necessary to investigate certain problems in testing for which there are no established methods of attack. Such experimentation is classified as research.

Considerable work of this nature has been undertaken during the past year by this department. Problems in connection with construction of oiled gravel roads have arisen which demand means of control not yet discovered. This type of construction has grown into one of major proportion, but is comparatively so new that all phases are not yet thoroughly understood.

Studies have therefore been made upon the oil used and upon the finished road surfacing. Several laboratory tests hitherto unprescribed were performed upon the oil, and although nothing of definite value was learned, the way was opened for additional study.

Most of the time was allotted to investigating the finished surfacing. Samples were taken of oiled gravel roads throughout the State, making sure to include gravel from each deposit used in construction. The bitumen was extracted from each sample, and the cleaned aggregate was subjected to a series of tests devised in the laboratory. A large amount of valuable data was compiled from these tests, but further work is necessary before definite conclusions can be drawn; nevertheless, two developments of importance have resulted from the work thus far accomplished.

The first of these is the derivation of a formula which affords means of field control in proportioning the quantities of oil and gravel more accurately than any heretofore used. Coincident with this development, there came a second. The department designed and constructed machines for field use in making rapid sieve analyses. This came as a necessity as the formula makes use of the grading of the aggregate, and since the tests must be frequent and results known immediately, too much delay would result from sending the samples to the testing laboratory.

The laboratory work of the Testing Department is not confined to testing for the State alone, although such is its chief concern. It is not the policy to encourage outside organizations to have their testing done in the department's laboratory. However, as a matter of courtesy and convenience to such parties, requests in this respect are often granted. During this biennium considerable testing has been done for the Government in connection with constructing the Naval Ammunition Depot at Hawthorne; for Forest road projects of the Bureau of Public Roads; for several Nevada cities, and for a few individuals. In all cases charges are made sufficient to cover the actual cost of testing. Exception is made in the case of the Bureau of Public Roads, for its laboratories reciprocate by performing certain tests for this department.

To name and describe all the various tests performed on road materials would involve more detail than is necessary to fulfill the purpose of this report. An attempt is made to classify and enumerate these tests in the table that follows. This table should give the reader some knowledge as to the kind and volume of tests performed during the past biennium.

Summary of Tests Biennium Ending November 30, 1930

Classification	Number of samples	Average No. tests per sample	Number of tests
Concrete Materials—			
Portland cement	36	7	252
Concrete sand	100	5	500
Concrete gravel	66	3	198
Concrete cylinders	821	1	821
Sand for cement rubble masonry	2	5	10
Water for use in concrete	7	3	21
Subtotal	1,032	....	1,802
Ferrous Materials—			
Reinforcing steel	82	2	164
Structural steel	8	2	16
Galvanized sheet metal	7	1	7
Spelter coated steel sheets for fabricating corrugated pipe	312	2	624
Corrugated steel pipe	312	2	624
Subtotal	721	....	1,435
Surfacing and Fill Material, Binder, Etc.—			
Surfacing gravel	405	4	1,620
Crushed rock	3	5	15
Mine dump rock for surfacing	3	4	12
Selected borrow material for fills	13	5	65
Selected binder for adding to surfacing material	25	4	100
Subtotal	449	....	1,812

SUMMARY OF TESTS—*Continued.*

Classification	Number of samples	Average No. tests per sample	Number of tests
Chemical Analyses—			
Steel sheets for corrugated pipe	5	6	30
Cement	2	4	8
Paint	1	4	4
Limestone	1	6	6
Amorphous graphite	1	1	1
Water	5	4	20
Subtotal	15	....	69
Bituminous Materials—			
Road oil	1,020	4	4,080
Oiled gravel	4	3	12
Oiled gravel stain tests	4	1	4
Gravel treated with asphaltic emulsion	1	4	4
Asphalt plank	1	2	2
Asphalt cement	1	1	1
Subtotal	1,031	....	4,103
Miscellaneous—			
Soil tests	6	7	42
Vitrified clay pipe	1	3	3
Selected material for covering sand	1	3	3
Gravel for bituminous treated landing field	4	2	8
Calcerous material	1	3	3
Sponge rubber joint	1	1	1
Unclassified	4	1	4
Subtotal	18	....	64
Material Used in Research—			
Road oils	16	4	64
Road oil (special)	1	8	8
Asphaltic emulsion	1	9	9
Cut-back asphalt (prepared in laboratory)	6	2	12
Cut back asphalt (commercial)	1	8	8
Oil treated gravel	97	5	485
Special sieve tests for gravel to be oiled	8	2	16
Distillation of road oils	5	4	20
Subtotal	135	....	622
*Field Tests**			
Oiled gravel stain tests	579	1	579
Hand-shaker sieve tests	365	1	365
Subtotal	944	....	944
Grand total samples and tests	4,345	....	10,851

*Incomplete.

MAINTENANCE REPORT

MAINTENANCE CREW AT WORK ON HIGHWAY NEAR TONOPAH.

MAINTENANCE REPORT

The maintenance of the State Highway System has become a major activity, and each year, as Federal and State funds are expended for road improvements, this activity becomes increasingly important in administering the income for highway purposes. Federal participation in highway construction is restricted by numerous regulations relative to the amount and character of work the State must perform to preserve the initial investment in highway improvements. Accordingly, all roads improved with Federal and State funds must be constantly maintained to the satisfaction of the Federal Government. The work is periodically inspected by representatives of the United States

TYPICAL MAINTENANCE CAMP.

Bureau of Public Roads, and if a Federal aid project is not intelligently and satisfactorily maintained the State is notified and given a certain amount of time to place the project in the required condition. If, after notification, the State continues to perform the work in an unsatisfactory manner, the Secretary of Agriculture has authority to curtail expenditures of Federal aid funds for highway improvements.

Under the provisions mentioned the State must, of course, carry on maintenance operations in a progressive and business-like manner at all times. Fortunately, in Nevada, it has not been necessary for the Federal representatives to exercise their authority to obtain satisfactory results. This amicable condition is due largely to the well-defined policies that were formulated when the maintenance department was organized.

In the expansion of the State Highway System the cost of maintenance is of vital importance to the financial welfare of the State and must be given due consideration in the annual budget. To determine the amount of money that can be expended for maintenance purposes, as well as improvements, it is important to have a certain amount of accurate and comprehensive information relative to the density and type of traffic using the highways. This information is obtained by an annual traffic survey. From the census compiled during the survey the Department can intelligently estimate the amount and character of work needed to properly maintain each section of road. Replacements, betterments and reconstruction are also governed by the volume of traffic.

The maintenance organization operates on a definite plan, and the

LINCOLN HIGHWAY ACROSS FOUR AND EIGHT MILE FLATS EAST OF FALLON.

expenditures on each section of road are governed by a budget made each year in accordance with the division engineers' recommendations. Each year's budget is based on known costs plus an allowance for extraordinary maintenance and betterment work. From past experience the cost of maintaining the various types of roads has become more or less standardized.

ORGANIZATION

The maintenance organization is under the direct supervision of five division engineers who are responsible to the State Highway Engineer for the numerous activities in their divisions. The highway system in each division is divided into short sections, the length of each section defined by the type of service and the volume of traffic which the road

carries. Each section is in charge of a working foreman who is supplied with whatever labor and equipment are necessary to adequately maintain his section. In some localities where the traffic load is comparatively light, several sections are placed under one foreman.

General maintenance includes various operations subject to seasonal conditions. Therefore, the foremen in charge of the work must be thoroughly familiar with the physical and climatic conditions in the vicinity of their sections. Furthermore, they must know the depth and width, character of the surfacing material, and the way each structure and other roadway facility functions.

Whenever extensive repairs or replacements are made the work is usually assigned to a gang fully equipped to meet the contingency. Each engineering division has a general utility foreman who is capable

STATE ROUTE NO. 3 BETWEEN TONOPAH AND MINA. TYPICAL SAND FENCE INSTALLATION ON LEFT.

of handling men and equipment. This foreman is responsible to the division engineer for all work requiring an unusual expenditure of funds. In addition he makes periodical inspections, supervises general maintenance operations, and keeps the equipment working and in repair.

MAINTENANCE METHODS

In Nevada, highway maintenance is divided into two main classes of operation, namely, general maintenance and specific or emergency maintenance.

General maintenance consists of ordinary routine work relative to keeping the roads smooth and free from corrugations and other irregularities. Certain types of roads and various traffic conditions warrant different operations; for example, dragging constitutes seventy per

cent of the work on a gravel surfaced road, while filling expansion joints and cracks and maintaining shoulders are the major operations on a cement concrete surfaced road.

The work of making extraordinary repairs and replacements caused by unusual climatic and other inestimable conditions is classed as specific or emergency maintenance. Under this classification are included removing slides and repairing washouts.

SNOW REMOVAL

It is impossible to average the seasonal snowfall in Nevada on account of the extreme climatic variations. The annual snowfall varies from 0.6 of an inch to 87 inches; the maximum fall occuring in the mountainous districts in the northern part of the State. With the

SNOW FENCE IN PLACE AT SUMMIT BETWEEN TONOPAH AND GOLDFIELD.

exceptions of the Arrowhead Trail in Clark County, and the Beatty-Las Vegas highway in Nye and Clark Counties, practically all of the improved mileage on the highway system lies within the area of snowfall. However, the fall is usually so light in most parts of the State that it is only necessary to clear about a thousand miles of highway during a season. Heavy wind storms increase the amount of snow removal in certain localities, and at times cause far more trouble in keeping the roads open than does the snowfall.

Provision is made by the Department to keep the main traveled highways free from snow blockades and open for winter traffic. In order to accomplish this, equipment suitable for snow removal is stationed at different points along the highway system just prior to the winter storm season, and as soon as snow begins falling removal operations

are commenced, and to prevent an accumulation the operations are continued throughout the duration of the storm. After the storm the division officer is notified of the condition of each section of road cleared.

Approximately three miles of snow fence are used for controlling wind movement and drifting. In some localities this type of protection has proven very effective, in others it was not so good, the effectiveness depending largely upon whether the winds are prevailing or variable. As a rule the fence is placed from one to four hundred feet from the roadway. Special attention is given to the results obtained from this method of protection and wherever it is practical additional fence is installed.

During the winter of 1928–1929 eight snow removal outfits were used

OIL SURFACED HIGHWAY ROUTE NO. 3 BETWEEN GOLDFIELD AND TONOPAH.

to advantage. The equipment available consisted of three rotary type snowplows, three push plows, fifteen trucks, ten tractors, seven large road graders, and several heavy duty trucks equipped with special frames for plow attachments. With the equipment mentioned the Department kept 820 miles of highway clear for a total cost of $15,115.61—or an average cost of about $18.50 a mile.

During the winter of 1929–1930 additional plows, trucks, tractors and blade graders were available, and the Department cleared and kept open 1,160 miles of highway for a total cost of $17,335.66—or an average cost of about $15 a mile. Snowfall during this winter was greater than the previous winter. This condition was general over the entire State. On January 10 and February 26, 1930, two of the heaviest storms of the season occurred. These required the use of all

the snow removal equipment. During these storms several of the roads were blocked to traffic from one to four days; the longest delay being on the Reno-Carson highway during the January storm.

BITUMINOUS TREATMENT

For several years the Department has realized the seriousness of the rapidly increasing traffic load and its relation to the cost of maintaining the State Highway System. In 1927 a plan was outlined to develop a program of reconstruction and oiling to reduce the inadequate and costly maintenance of gravel surfaced roads that were rapidly becoming unserviceable.

In formulating the program several different types of surfaces and surfacing were considered; and a bituminous treatment, commonly known as "Bituminous Surface Mixing Method" was adopted. The first experimental oil treatment was applied during 1927 by copying the method developed by California. Since then a number of details have been successfully introduced into the working operations which have developed a uniform process to meet the requirements peculiar to Nevada's climatic conditions.

METHOD OF MIXING

Under the present oiling method the reconstructed gravel roadway surface is scarified and reshaped to conform to an approved cross section, and additional crushed gravel added to give the thickness of loose material required to produce the compacted depth of top course to be treated. The new material is uniformly spread by blading back and forth until the surface conforms to the design specified. Then the final shaping is done with a heavy combination scarifier and planer, which performs the two operations simultaneously, leaving the roadway surface in shape for applying oil. After the grading of the material has been accurately determined by field tests, fuel oil containing from 65 to 75% of 80 penetration asphalt is distributed in three applications, each consisting of approximately one-third of the total amount needed. The total amount of oil required varies from ½ to ¾ gallon to the square yard per inch of penetration, depending upon the grading classification and characteristics of the material. After each application the oil is thoroughly mixed with the loose surfacing material by means of discs and spring tooth harrows worked in tandem. The amount of disking and harrowing is governed somewhat by the progress of the blading operation which follows, but depends mainly upon atmospheric conditions and the viscosity and temperature of the oil. However, the oil is always partially distributed throughout the material before the blading operation is commenced.

After the harrowing and disking has been satisfactorily completed the material is bladed from the sides of the road to the center. When all the material has been windrowed it is flattened and again thoroughly disced and harrowed until the entire mixture is ready for quartering and turning back toward the sides of the road. This process of turning and mixing the material from the sides of the road toward the center, windrowing, quartering, and then turning back, is repeated several times until the mixture has attained a uniform color. The number of turns and amount of mixing depend upon how the oil

penetrates. As a rule not less than twenty passages of the blade grader will produce the desired results.

After the turning operation is completed the mixture is examined to determine if the correct amount of oil has been used. In case of doubt a stain test is applied. If the proportion of oil is excessive the base course is lightly scarified and the loosened road metal added to the mixture. If more oil is required the mixture is spread evenly over the roadway and additional oil distributed thereon. In either case the mixing is resumed when the correction has been made and is continued until the required uniformity is secured.

When the mixing has been satisfactorily completed the material is bladed back and forth across the road until a smooth profile and true cross section have been attained and no streaks of unmixed material are left in the finished surface. To eliminate the possibility of having any unmixed material on the surface the top inch of finished surface is again harrowed, bladed, mixed and spread to a uniform thickness. After this operation the surface is ready for compaction.

During the first stage of compaction a small blade grader, or light road planer, at least 16 feet long, is used to remove all irregularities from the surface. If fat spots develop during compaction the area in question is loosened and additional gravel incorporated to correct the condition. If lean spots develop additional oil is applied for the correction. Whenever traffic is inclined to hold to the center of the road during compaction a light roller is used to start compaction from the quarter sections to the shoulder lines. This promotes a more even distribution of the traffic load and causes a more uniform compaction.

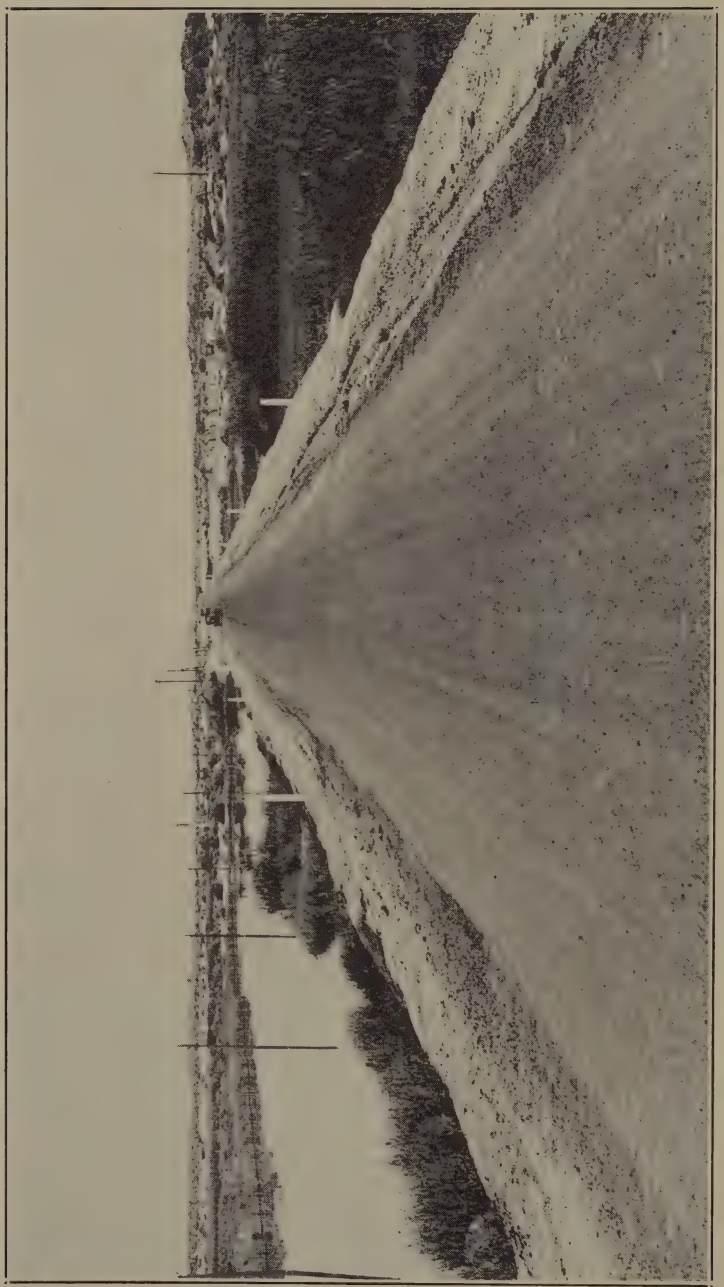
As the type of surface obtained by the foregoing treatment is non-rigid, it is essential to drain all waters from the roadway section, and especially from the supporting grade, to eliminate capillarity and subsequent failure. Wherever the soil in the supporting grade is high in capillarity, it is also necessary to break the bond between the treated surface and the sub-base soil with a mat of selected gravel and sand; otherwise the life of the treated surface is very short and it is impossible to maintain a smooth surface. To obtain the best results it is important to control the small factors which enter into the work as well as the major operations.

Each succeeding year the Department has added refinements to the work, such as increasing the depth of treated material at the sides of the road, improving surface and shoulder drainage, remixing the top inch of finished material for a wearing course, dragging and rolling to promote compaction.

From the results obtained the Department feels assured that bituminous treatment of Nevada's gravel surfaced roads is the economical solution for relieving the dust nuisance and loose gravel hazard, as well as increasing the serviceability of the State Highway System.

MAINTENANCE REPORT 1929

During the State's fiscal year ending November 30, 1929, the Department spent $418,065.08 for maintaining 1,875.16 miles of road on the State Highway System. The total mileage maintained includes



OIL ROAD ACROSS MAHALA MARSH NEAR FALLON ON LINCOLN HIGHWAY.

improved, semi-improved and unimproved types of road. The total cost includes all direct and indirect charges to maintenance, also equipment rentals, erection of standard road markers and signs, and the construction of a maintenance house. The mileage and expenditures are divided as follows:

TABLE NO. 11

Type of road or classification	Mileage	Expenditures
Concrete	45.79	$15,691.66
Asphalt macadam	20.56	4,817.29
Bituminous treated surface	270.60	33,388.03
Gravel	1,026.03	271,292.68
Improved (graded only)	272.47	61,240.25
Unimproved	235.65	6,165.95
[1]Forest highway	4.06	1,096.79
[2]Signing	.....	1,096.65
[3]Maintenance house	.....	954.73
[4]Bridge repair	.....	145.65
[5]Miscellaneous	.....	22,175.40
Totals	1,875.16	$418,065.08

[1]$1,096.79 was expended for maintaining 4.06 miles of forest highway in White Pine County, for which the Department is to be reimbursed by the Government.

[2]$1,096.65 was expended in the erection of United States standard road markers and warning signs on United States Routes 40, 50, and 91.

[3]$954.73 represents the cost of constructing a maintenance house at Ferguson Springs in Elko County.

[4]$145.65 is the final expenditure for repairs to the bridge across the Humboldt River at Dunphy in Eureka County.

[5]The miscellaneous expenditure of $22,175.40 is divided as follows:

$5,380.29	Resurfacing (gravel)—Lander 2-D.
4,790.54	Reconditioning (oil sand)—Nye 5-D-E.
201.55	Installing culvert—White Pine 2-D.
106.90	Repairing damage caused by cloudburst—Esmeralda 5-A.
277.18	Construction of diversion ditches—Nye (Calloway-Duckwater).
421.83	Repairing washouts—Clark 5-E-F.
115.46	Repairing washouts—Clark 6-D-2.
10,653.62	Repairing damage to Virgin River bridge caused by cloudburst.
223.03	Timber curb for gravel dips—Nye 8-A-A.
$22,175.40	

The cost per mile for maintaining the various types is as follows:

TABLE NO. 12

Type of surface	Mileage	Cost	Cost per mile
Concrete	45.79	$15,691.66	$342.69
Asphalt macadam	20.56	4,817.29	234.30
Bituminous treated surface	149.37	33,388.03	223.53
Gravel	998.89	271,292.68	271.59
Improved (graded only)	267.72	61,240.25	228.75
Unimproved	235.65	6,165.95	26.17
Totals	1,717.98	$392,595.86	$228.52

During the year 216.75 miles of oiling were placed under agreement, but only 185.63 miles were completed and maintained during part of the year. The mileage completed is prorated into graveled and bituminous treated roads in proportion to the number of months each type was maintained. The same arrangement is used to care for 87.73 miles of new construction. Therefore, the total mileage as shown in Table No. 14 includes the mileage maintained the full year plus the prorated mileage.

Table No. 13 shows the expenditure made for the different maintenance operations on concrete, asphalt macadam, and bituminous treated roads:

TABLE NO. 13

Operation	Concrete	Per cent	Asphalt macadam	Per cent	Bituminous treated	Per cent
Maintaining shoulders	$7,083.19	45.1	$2,198.37	45.6	$7,171.37	21.5
Filling expansion joints and cracks	1,177.31	7.5				
Cleaning culverts and ditches	1,048.76	6.7	1,461.26	30.3	2,298.45	6.9
Cutting weeds and brush	1,134.65	7.2	231.38	4.8	1,258.03	3.8
Patching surface	1,051.08	6.7	505.26	10.5	9,663.55	28.9
Removing slides and trimming slopes	1,949.18	12.4	62.88	1.3	671.41	2.0
Repairing washouts	143.99	0.9	28.70	0.6	1,867.38	5.6
Removing snow	1,097.10	7.0	51.99	1.1	323.97	1.0
Protecting guard rail	310.86	2.0	61.99	1.3	302.87	0.9
Protecting slopes and rip rapping	164.02	1.1			30.33	0.1
Painting (general)	150.10	1.0	38.87	0.8	317.50	0.9
Building and repairing bridges and culverts	108.54	0.7	94.23	2.0	401.22	1.2
Painting traffic center line	19.39	0.1				
Reconditioning					8,502.86	25.5
Administration	253.49	1.6	82.36	1.7	579.09	1.7
Totals	$15,691.66		$4,817.29		$33,388.03	

The expenditures on other types of roads are analyzed in Table No. 14.

TABLE NO. 14

Operation	Gravel	Per cent	Improved	Per cent	Unimproved	Per cent
Cleaning culverts and ditches	$6,235.51	2.3	$1,481.91	2.4	$5.74	0.1
Cutting weeds and brush	1,454.90	0.5	331.11	0.5		
Dragging	192,521.66	71.0	39,978.57	65.3	4,890.40	79.3
Sprinkling	826.71	0.3			5.65	0.1
Raking rocks	6,749.96	2.5	2,330.82	3.8	615.75	10.0
Removing slides and trimming slopes	2,244.08	0.8	943.15	1.5	19.09	0.3
Washouts	11,184.90	4.1	5,035.90	8.2		
Surfacing	27,401.47	10.1	7,382.29	12.1	373.18	6.1
Removing snow	13,695.46	5.1	1,003.53	1.6		
Protecting guard rail	1,121.74	0.4	9.42		150.73	2.4
Protecting slopes and rip rapping	866.56	0.3	31.38	0.1		
Painting (general)	1,341.97	0.5	270.68	0.5		
Building and repairing bridges and culverts	1,036.71	0.4	1,396.66	2.3		
Administration	4,611.05	1.7	1,044.83	1.7	105.41	1.7
Totals	$271,292.68		$61,240.25		$6,165.95	

Table No. 15 shows the mileage maintained and the expenditures in each county:

TABLE NO. 15

County	Mileage	Expenditures
Churchill	123.06	$27,284.28
Clark	162.56	49,797.41
Douglas	56.92	12,698.62
Elko	138.38	36,180.34
Esmeralda	207.91	16,499.82
Eureka	72.70	17,374.27
Humboldt	81.09	16,052.66
Lander	125.90	35,363.50
Lincoln	79.49	13,633.74
Lyon	82.22	27,961.48
Mineral	107.05	24,193.06
Nye	278.37	53,600.24
Ormsby	14.60	4,499.68
Pershing	74.90	21,188.10
Storey	6.63	434.76
Washoe	84.80	27,411.77
White Pine	174.52	31,697.93
Totals	1,871.10	$415,871.66
White Pine County Forest Highway	4.06	1,096.78
Signing U. S. Route 40	.....	448.45
Signing U. S. Route 50	.....	446.47
Signing U. S. Route 91	.....	201.72
Totals	1,875.16	$418,065.08

MAINTENANCE REPORT 1930

During the fiscal year ending November 30, 1930, $500,752.46 was spent for maintaining 1905.43 miles of road. The total mileage includes improved and unimproved types of road and the total cost includes all direct and indirect charges to maintenance.

TABLE NO. 16

Type of road or classification	Mileage	Expenditures
Concrete	45.79	$19,707.41
Asphalt macadam	20.56	5,688.83
Bituminous treated surface	430.71	62,711.82
Gravel	1,017.43	286,988.65
Improved (graded only)	328.74	56,502.54
Unimproved	59.12	8,096.10
[1]Forest highway	3.08	720.60
[2]Miscellaneous	----------	60,336.51
Totals	1,905.43	$500,752.46

[1]$720.60 was expended for maintaining 3.08 miles of forest highway in Douglas County (Spooners to top of Glenbrook Hill) for which the Department is to be reimbursed by the Government.

[2]The miscellaneous expenditures of $60,336.51 are divided as follows:

$105.81	Construction of diversion ditches—Calloway to Duckwater.
6,705.27	Repairs to Virgin and Muddy River bridges.
387.62	Timber curbs for gravel dips—Nye 8 A-A.
158.50	Partial expenditure for construction of maintenance house—Lathrop Well.
22.27	Partial expenditure for construction of maintenance house—Near Glendale.
3,528.28	Construction of an oil storage plant at Las Vegas.
1,261.56	Construction of a maintenance house at Becky Springs.
976.92	Betterment work—Clark 7-A, 24 miles.
2,579.34	Betterment work—Nye and Esmeralda 5 H-1 and 3 B-2, 5 A-2; 26.19 miles.
9,592.07	Betterment work—Lincoln 7-A, 107 miles.
374.95	Piping water to maintenance camp at Becky Springs.
1,790.01	Daylighting cut on Clear Creek road—Douglas County.
258.29	Placing standard United States signs—14 miles west Hay Ranch to Wendover.
766.24	Cleaning ditches—Washoe 1-B-4.
832.01	Cost and installation of 640 feet perforated corrugated culvert pipe—Clear Creek road.
16.18	Furnishing, erecting and replacing signs in Division No. 1.
359.53	Work on drain in vicinity of Fernley.
13,731.94	Reconditioning and seal coating Tonopah-Millers and Tonopah-Goldfield oil sections.
1,593.74	Repairing washouts caused by cloudbursts—Nye and Esmeralda Counties.
323.48	Concrete piling—Caliente bridge.
398.66	Betterment work, Storey 17-B, 3.88 miles.
23.38	Furnishing, erecting and replacing signs—Division 5.
4,318.73	Reconditioning and seal coating—Pershing 1-A.
3,453.66	Reconditioning and seal coating—Pershing 1-C.
1,682.55	Reconditioning and seal coating—Clark 6 D-2.
3,584.12	Reconditioning and seal coating—Clark 6 E-1.
1,511.40	Reconditioning and seal coating—Clark 6 C-2.
$60,336.51	

The cost per mile for maintaining the various types is as follows:

TABLE NO. 17

Type of surface	Mileage	Cost	Cost per mile
Concrete	45.79	$19,707.41	$430.39
Asphalt macadam	20.56	5,688.83	276.69
Bituminous treated surface	348.98	62,711.82	179.70
Gravel	1,096.59	286,988.65	261.71
Improved (graded only)	294.91	56,502.54	191.59
Unimproved	59.12	8,096.10	136.94
Totals	1,865.95	$439,695.35	$235.64

During the year 175.09 miles of gravel road were oil treated. The mileage completed is prorated into graveled and bituminous treated roads in proportion to the number of months each type was maintained. The same arrangement is used to care for 56.74 miles of new construction. Therefore, the mileage, as shown in Table No. 19

TABLE NO. 18

Operation	Concrete	Per cent	Asphalt macadam	Per cent	Bituminous treated	Per cent
Maintaining shoulders	$6,528.85	33.1	$2,582.11	45.4	$16,675.77	26.6
Filling expansion joints and cracks	2,229.46	11.3				
Cleaning culverts and ditches	2,163.02	11.0	1,227.15	21.6	6,008.09	9.6
Cutting weeds and brush	1,998.62	10.1	478.99	8.4	1,873.80	3.0
Patching surface	1,654.38	8.4	439.04	7.7	21,767.04	34.7
Removing slides and trimming slopes	516.75	2.6	48.57	0.9	1,674.08	2.7
Repairing washouts	90.12	0.5	189.88	3.3	6,621.24	10.5
Removing snow	3,396.05	17.2	379.35	6.7	2,051.10	3.3
Protecting guard rail	144.76	0.7	142.95	2.5	855.01	1.4
Protecting slopes and rip rapping	48.54	0.2	9.42	0.2	189.86	0.3
Painting (general)	386.03	2.0	50.16	0.9	629.59	1.0
Building and repairing bridges and culverts	57.28	0.3	41.46	0.7	200.14	0.3
Painting traffic center line	147.99	0.8				
Reconditioning					2,855.20	4.5
Administration	345.56	1.8	99.75	1.7	1,310.90	2.1
Totals	$19,707.41		$5,688.83		$62,711.82	

The expenditures on other types of roads are analyzed in Table No. 19.

TABLE NO. 19

Operation	Gravel	Per cent	Improved	Per cent	Unimproved	Per cent
Cleaning culverts and ditches	$7,354.53	2.6	$1,066.17	1.9	$78.18	0.9
Cutting weeds and brush	2,069.79	0.7	197.87	0.4		
Dragging	212,006.04	73.9	38,181.21	67.6	7,018.44	86.7
Sprinkling	235.01	0.1	160.26	0.3		
Raking rocks	8,411.22	2.9	1,331.26	2.4	260.28	3.2
Removing slides and trimming slopes	3,797.21	1.3	1,747.00	3.0	18.24	0.2
Washouts	10,569.26	3.7	900.62	1.6	119.03	1.5
Surfacing	19,495.09	6.8	6,261.60	11.0	357.37	4.4
Removing snow	11,904.97	4.2	1,679.23	2.9	55.58	0.7
Protecting guard rail	1,835.95	0.6	75.43	0.1	9.12	0.1
Protecting slopes and rip rapping	1,433.12	0.5	192.79	0.4		
Painting (general)	1,616.51	0.5	168.52	0.3		
Building and repairing bridges and culverts	1,183.97	0.4	3,549.72	6.3	37.90	0.5
Administration	5,075.98	1.8	990.86	1.8	141.96	1.8
Totals	$286,988.65		$56,502.54		$8,096.10	

includes the mileage maintained the full year plus the prorated mileage.

Table No. 18 shows the expenditures made for the different maintenance operations on concrete, asphalt macadam and bituminous treated roads.

Table No. 20 shows the total expenditures for maintenance and betterment work in each county. The total mileage includes 161.07 miles of betterment work.

TABLE NO. 20

County	Mileage	Expenditures
Churchill	123.07	$30,955.78
Clark	204.36	65,237.80
Douglas	53.21	16,776.15
Elko	192.01	53,316.99
Esmeralda	110.08	33,162.23
Eureka	72.70	20,584.72
Humboldt	102.19	17,009.37
Lander	125.90	28,417.28
Lincoln	207.68	23,362.00
Lyon	104.58	28,070.40
Mineral	106.44	26,021.31
Nye	252.56	55,079.58
Ormsby	14.60	4,682.75
Pershing	74.81	26,145.05
Storey	10.51	1,439.82
Washoe	84.80	33,888.76
White Pine	223.92	35,881.87
Totals	2,063.42	$500,031.86
Douglas County Forest Highway	3.08	720.60
Totals	2,066.50	$500,752.46

ANNUAL TRAFFIC SURVEY

To determine the improvements and replacements in accord with present and estimated future traffic needs, it is essential to have a certain amount of comprehensive information relative to the density and type of traffic using the highway system. In order to obtain this information the Department has conducted a traffic survey each year since 1922. During this survey, which is made over a seven-day period in July, the usage of all parts of the highway system is determined by counting the number of vehicles passing fifty-six survey stations located at established points throughout the entire State. In addition to recording the total number of vehicles passing each point, an accurate classification of the number of trucks and busses, foreign cars (cars registered from outside the State), Nevada registered cars, motorcycles and horse-drawn vehicles is made. From this survey a traffic census is compiled and published for free distribution.

The traffic count is made over a sixteen-hour period, between the hours of 6 a. m. and 10 p. m. However, during the last two surveys, the count was extended over a full twenty-four hour period at certain stations for the purpose of determining the number of vehicles using the highways between 10 p. m. and 6 a. m. The figures are shown for 1930 in the footnotes of the Traffic Census Report.

There is a wide variation in the amount of travel using the highway system which has been noticeable in the life of the roads as well

as in the costs of maintenance and betterment work. The bulk of traffic is, of course, over roads in the densely populated sections. But regardless of the location of the road, or its connections with other roads, there is a wide variation in seasonal travel which makes it extremely difficult to estimate the average daily use. A comparative study of the traffic counts for 1929 and 1930 shows the following:

On Route 1, between Reno and Verdi, traffic increased 13.7 per cent during 1929 over the previous year. In 1930 the same section showed a decrease of 6.9 per cent. On the same route, east of Sparks, there was an increase recorded in 1929 of 105.8 per cent over 1928; and the same section showed a loss of 22.6 per cent when the 1930 count was completed. At a point one-half mile west of Elko, traffic increased 55.1 per cent during 1930 over the count for the preceding year.

Probably the outstanding traffic increase has occurred in the vicinity of Las Vegas on the Arrowhead Trail. Since the first count was made in 1926, or over a four-year period, an average yearly increase of more than 60 per cent has been recorded. And now, with the construction of the Boulder Dam project, there is no doubt that the volume of travel will more than double during each succeeding year on the Arrowhead Trail.

Table No. 21 shows the complete tabulation of the traffic census as recorded since the first count was made in 1922. The per cent increase or decrease shown is for comparison between the years 1929 and 1930.

Cooperative Traffic Survey

During 1929 and 1930 the United States Bureau of Public Roads and this Department conducted a coordinated traffic survey of the Federal Aid System in Nevada under a cooperative agreement. The objectives of this survey were:

(1) Complete information relative to daily and seasonal traffic variation by types of vehicles.

(2) The States of origin and of destination of traffic over each route.

(3) Complete information of traffic density on all sections of Federal aid routes and of feeder routes at points of intersection with Federal aid routes.

(4) Truck capacity distribution for each section of these routes.

(5) Situs of ownership (farm, village or city) of vehicles for each State or section thereof.

(6) Number of passengers carried by States or sections thereof.

(7) Data relative to highway usage by out-of-State cars.

(8) A sound basis for forecasting future traffic, and the classification of all sections of Federal aid routes.

In addition to the specific objectives proposed by the Bureau of Public Roads, as stated above, the information is to be used to determine the results of experimental work; to provide data to guide the further improvement of the Federal Aid System; and to indicate the extent of seasonal tourist travel.

TABLE NO. 21

ROUTE 1

	1930 Daily Average	1929 Daily Average	1928 Daily Average	1927 Daily Average	1926 Daily Average	1925 Daily Average	1924 Daily Average	1923 Daily Average	1922 Daily Average	Per Cent Increase or Decrease Over 1929
Reno-Verdi, one-half mile west of Reno—										
Total vehicles*[1]	2110	2266	1993	1777	1852	1601	700	.....	.....	— 6.9
Trucks and busses	105	152	132	90	218	121	35			
Foreign cars	906	867	801	762	477	365	170			
Nevada cars	1084	1227	1051	913	1122	1065	472			
M. and H. D.†	15	20	9	12	35	50	23			
Reno-Sparks at Coney Island—										
Total vehicles[2]	5383	4858	3797	3532	2832	3286	2809	2235	1626	+ 10.8
Trucks and busses	494	408	488	203	366	233	199	171	95	
Foreign cars	1272	1161	780	846	502	593	357	247	87	
Nevada cars	3560	3246	2487	2469	1933	2436	2204	1759	1402	
M. and H. D.	57	43	42	23	31	24	49	58	42	
East city limits Sparks—										
Total vehicles	881	1138	553	.....	.....	.....	.....	.....	.....	— 22.6
Trucks and busses	74	107	38							
Foreign cars	408	421	287							
Nevada cars	392	598	224							
M. and H. D.	7	12	4							
On Victory Highway at Junction with Route Two—										
Total vehicles[3]	394	368	309	258	153	75	53	56	.....	+ 7.1
Trucks and busses	9	10	14	15	2	1	2	1		
Foreign cars	291	296	231	164	133	57	38	40		
Nevada cars	92	60	62	78	17	15	13	13		
M. and H. D.	2	2	2	1	1	2	0	2		
One-half mile south of Winnemucca—										
Total vehicles	564	479	418	361	295	204	160	189	.....	+ 17.7
Trucks and busses	34	23	25	13	8	8	8	15		
Foreign cars	298	304	261	203	141	64	43	50		
Nevada cars	229	149	130	143	144	130	108	122		
M. and H. D.	3	3	2	2	2	2	1	2		

One mile west of Battle Mountain—										
Total vehicles	379	396	318	245	196	.....	75	.....	.....	—4.3
Trucks and busses	9	17	15	9	3	.....	5			
Foreign cars	269	277	227	185	132	.....	19			
Nevada cars	100	99	73	49	57	.....	50			
M. and H. D.	1	3	3	2	4	.....	1			
One-half mile west of Elko—										
Total vehicles[4]	718	463	438	329	341	299	289	149	.....	+55.1
Trucks and busses	49	51	21	4	18	54	19	10		
Foreign cars	341	271	261	189	156	57	49	42		
Nevada cars	326	139	154	135	164	185	219	94		
M. and H. D.	2	2	2	1	2	3	2	3		
One mile east of Deeth—										
Total vehicles	429	467	367	307	.....	.....	.....	.....	.....	—8.1
Trucks and busses	16	13	23	10						
Foreign cars	293	304	236	197						
Nevada cars	119	148	106	98						
M. and H. D.	1	2	2	2						
Two miles east of Wells—										
Total vehicles	313	333	244	230	.....	.....	.....	.....	.....	—6.0
Trucks and busses	13	23	9	5						
Foreign cars	218	254	201	192						
Nevada cars	81	55	32	33						
M. and H. D.	1	1	2	0						
Junction Routes One and Twenty-four to Wells—										
Total vehicles	271									
Trucks and busses	9									
Foreign cars	244									
Nevada cars	17									
M. and H. D.	1									

*All reference notes refer to 24-hour count showing daily average of vehicles using highways between 10 p. m. and 6 a. m.
†Motorcycles and horse-drawn vehicles.
[1]396 vehicles or 15.8% of total traffic. Total traffic, 2506.
[2]700 vehicles or 11.5% of total traffic. Total traffic, 6083.
[3]40 vehicles or 9.2% of total traffic. Total traffic, 434.
[4]134 vehicles or 15.7% of total traffic. Total traffic, 852.

ROUTE 1—*Continued.*

	1930 Daily Average	1929 Daily Average	1928 Daily Average	1927 Daily Average	1926 Daily Average	1925 Daily Average	1924 Daily Average	1923 Daily Average	1922 Daily Average	Per Cent Increase or Decrease Over 1929
Junction Routes One and Twenty-four to Salt Lake City—										
Total vehicles	331									
Trucks and busses	16									
Foreign cars	279									
Nevada cars	35									
M. and H. D.	1									
ROUTES 1 AND 2										
Junction Victory and Lincoln Highways—										
Total vehicles[5]	688	598	590	490	.....	.....	.....	.....	.....	+ 15.1
Trucks and busses	28	28	42	35						
Foreign cars	360	341	307	269						
Nevada cars	294	226	239	184						
M. and H. D.	6	3	2	2						
ROUTE 2										
On Lincoln Highway at Junction with Route One—										
Total vehicles[6]	342	230	281	.....	.....	.....	.....	.....	.....	+ 48.7
Trucks and busses	23	18	28							
Foreign cars	81	45	76							
Nevada cars	234	166	177							
M. and H. D.	4	1	0							
Lecterille-Fallon at Lecterille—										
Total vehicles	297	235	205	235	172	141	149	128	.....	+ 26.4
Trucks and busses	28	24	21	22	12	8	9	5		
Foreign cars	75	56	53	65	34	43	36	32		
Nevada cars	193	155	130	146	125	89	102	88		
M. and H. D.	1	0	1	2	1	2	2	3		
Three miles west of Hazen—										
Total vehicles	258	187	176	222	.....	.....	.....	.....	.....	+ 38.0
Trucks and busses	29	21	21	22						
Foreign cars	70	44	56	61						
Nevada cars	158	122	99	137						
M. and H. D.	1	0	0	2						

Salt Wells—										
Total vehicles	114	108	85	102	98	82	72	61	.....	+ 5.6
Trucks and busses	15	18	13	21	19	12	12	5		
Foreign cars	32	32	28	40	26	32	30	35		
Nevada cars	67	58	44	40	53	37	31	21		
M. and H. D.	0	0	0	1	0	1	2	0		
One-fourth mile east of Austin—										
Total vehicles	100	85	68	92	106	83	58	210	.....	+ 17.6
Trucks and busses	4	9	1	5	6	9	4	16		
Foreign cars	31	32	28	46	31	38	26	58		
Nevada cars	65	43	38	40	68	35	28	116		
M. and H. D.	0	1	1	1	1	1	0	20		
Ely to Eureka at Keystone—										
Total vehicles	123	106	99	99	110	99	413	313	.....	+ 16.0
Trucks and busses	15	8	20	9	18	7	54	43		
Foreign cars	25	23	30	29	33	40	62	56		
Nevada cars	83	75	48	61	58	51	293	196		
M. and H. D.	0	0	1	0	1	1	4	18		
Ely-Keystone—										
Total vehicles	947	1066	737	545	526	515	.....	.....	.....	— 11.2
Trucks and busses	77	103	83	55	75	64				
Foreign cars	77	150	116	71	74	121				
Nevada cars	791	806	537	419	396	325				
M. and H. D.	2	7	1	0	1	5				
Ely to Ruth at Keystone—										
Total vehicles	894	960	738	446	416	416	.....	.....	.....	— 6.9
Trucks and busses	60	96	63	46	57	57				
Foreign cars	65	126	86	42	41	81				
Nevada cars	767	731	489	358	318	274				
M. and H. D.	2	7	0	0	0	4				
Ely-McGill at Airport—										
Total vehicles[7]	811	850	631	450	657	435	346	.....	.....	— 4.6
Trucks and busses	93	120	101	32	105	82	39			
Foreign cars	81	78	77	70	69	51	59			
Nevada cars	635	648	450	346	480	300	245			
M. and H. D.	2	4	3	2	3	3	3			

[5]71 vehicles or 17.2% of total traffic. Total traffic, 413.

[6]106 vehicles or 13.3% of total traffic. Total traffic, 794.

[7]176 vehicles or 17.8% of total traffic. Total traffic, 987.

ROUTE 2A

	1930 Daily Average	1929 Daily Average	1928 Daily Average	1927 Daily Average	1926 Daily Average	1925 Daily Average	1924 Daily Average	1923 Daily Average	1922 Daily Average	Per Cent Increase or Decrease Over 1929
Lecteville-Carson—										
Total vehicles	73	114	63	61	75	80	71	49	.....	—36.0
Trucks and busses	5	6	3	3	4	4	4	2		
Foreign cars	9	14	7	11	14	20	19	10		
Nevada cars	59	93	53	46	56	55	46	37		
M. and H. D.	0	1	0	1	1	1	2	0		

ROUTE 3

Reno-Carson North of Moana—										
Total vehicles[8]	2833	2164	2302	2104	1876	1808	2202	1825	1270	+30.9
Trucks and busses	86	86	109	106	74	25	123	54	57	
Foreign cars	618	495	496	583	338	341	282	247	92	
Nevada cars	2096	1563	1683	1395	1454	1431	1759	1493	1075	
M. and H. D.	33	20	14	20	10	11	38	32	46	
Reno-Carson into Moana—										
Total vehicles[9]	594	459	530	741	345	404	.....	.....	.....	+29.4
Trucks and busses	13	12	15	30	7	1				
Foreign cars	68	53	82	194	45	51				
Nevada cars	502	389	431	510	291	350				
M. and H. D.	11	5	2	7	2	2				
Reno-Carson south of Moana—										
Total vehicles[10]	2415									
Trucks and busses	75									
Foreign cars	568									
Nevada cars	1751									
M. and H. D.	21									
Reno-Carson at Geiger Grade—										
Total vehicles	1445	1529	1200	1135	848	.....	.....	.....	.....	—5.5
Trucks and busses	85	68	56	50	36					
Foreign cars	417	391	332	373	215					
Nevada cars	932	1059	803	706	594					
M. and H. D.	11	11	9	6	3					

Junction Reno-Carson to Virginia City—

Total vehicles	111	115	99	103	123	85	.....	.....	.....	—3.5
Trucks and busses	76	17	8	6	7	11				
Foreign cars	26	25	24	19	21	17				
Nevada cars	9	71	65	76	95	56				
M. and H. D.	0	2	2	2	0	1				

Carson City-Lakeview south of Springs Road—

Total vehicles[11]	906	970	1026	955	.....	637	.....	.....	.....	—6.6
Trucks and busses	59	59	60	40	.....	29				
Foreign cars	296	324	242	302	.....	155				
Nevada cars	550	582	721	607	.....	446				
M. and H. D.	1	5	3	6	.....	7				

Carson City-Lakeview north of Springs Road—

Total vehicles[12]	846
Trucks and busses	57
Foreign cars	298
Nevada cars	490
M. and H. D.	1

Carson City-Lakeview into Hot Springs—

Total vehicles[13]	65
Trucks and busses	4
Foreign cars	18
Nevada cars	43
M. and H. D.	0

Carson City-Minden north of Wye—

Total vehicles[14]	807
Trucks and busses	53
Foreign cars	310
Nevada cars	442
M. and H. D.	2

[8]449 vehicles or 13.7% of total traffic. Total traffic, 3282.
[9]137 vehicles or 18.7% of total traffic. Total traffic, 731.
[10]183 vehicles or 7% of total traffic. Total traffic, 2598.
[11]103 vehicles or 10.2% of total traffic. Total traffic, 1009.
[12]96 vehicles or 10.3% of total traffic. Total traffic, 936.
[13]9 vehicles or 12.2% of total traffic. Total traffic, 74.
[14]103 vehicles or 11.3% of total traffic. Total traffic, 910.

ROUTE 3—*Continued.*

	1930 Daily Average	1929 Daily Average	1928 Daily Average	1927 Daily Average	1926 Daily Average	1925 Daily Average	1924 Daily Average	1923 Daily Average	1922 Daily Average	Per Cent Increase or Decrease Over 1929
Carson City-Minden south of Wye—										
Total vehicles[15]	422	448	552	456	321	255	231	.....	.....	— 5.8
Trucks and busses	39	40	48	29	21	9	12			
Foreign cars	146	137	142	147	89	69	51			
Nevada cars	236	270	358	280	209	175	160			
M. and H. D.	1	1	4	0	2	2	8			
Clear Creek Road—										
Total vehicles[16]	408	438	.....	.....	.....	.....	.....	.....	.....	— 6.8
Trucks and busses	25	27								
Foreign cars	176	233								
Nevada cars	206	176								
M. and H. D.	1	2								
Junction into Stewart—										
Total vehicles	48									
Trucks and busses	4									
Foreign cars	5									
Nevada cars	39									
M. and H. D.	0									
Gardnerville-Minden—										
Total vehicles	1367	1346	1304	1036	1002	832	908	853	750	+ 1.6
Trucks and busses	151	153	131	95	148	86	78	62	89	
Foreign cars	297	262	241	252	184	173	122	156	51	
Nevada cars	899	926	917	684	656	561	686	603	561	
M. and H. D.	20	5	15	3	14	12	22	32	49	
Gardnerville-Wellington north of Junction—										
Total vehicles	258	288	243	254	.....	.....	104	.....	.....	— 10.4
Trucks and busses	27	29	18	18	.....	.....	21			
Foreign cars	162	171	145	168	.....	.....	44			
Nevada cars	69	88	80	66	.....	.....	39			
M. and H. D.	0	0	0	2	.....	.....	0			

Gardnerville and Wellington south of Junction—										
Total vehicles	81									
Trucks and busses	10									
Foreign cars	25									
Nevada cars	46									
M. and H. D.	0									
Topaz Road—										
Total vehicles	192	177	147	.....	.....	.....	.....	.....	.....	+ 8.5
Trucks and busses	18	13	11							
Foreign cars	142	142	118							
Nevada cars	32	22	18							
M. and H. D.	0	0	0							
One mile east of Yerington—										
Total vehicles	207	206	205	195	.....	.....	.....	.....	.....	+ .5
Trucks and busses	10	28	36	34						
Foreign cars	26	22	12	12						
Nevada cars	167	152	153	145						
M. and H. D.	4	4	4	4						
West Walker Lake—										
Total vehicles	98	92	35	28	59	46	28	31	.....	+ 6.5
Trucks and busses	9	10	2	1	3	3	2	4		
Foreign cars	25	15	8	6	15	14	3	6		
Nevada cars	64	66	24	20	41	29	21	21		
M. and H. D.	0	1	1	1	0	1	2	0		
On Route Three at Junction 8-A—										
Total vehicles	283	172	.....	.....	.....	.....	.....	.....	.....	+ 64.5
Trucks and busses	20	5								
Foreign cars	82	16								
Nevada cars	181	150								
M. and H. D.	0	1								
Tonopah-Goldfield—										
Total vehicles	253	241	392	397	208	207	133	184	.....	+ 5.0
Trucks and busses	10	18	30	30	14	5	1	10		
Foreign cars	26	29	36	43	19	29	12	17		
Nevada cars	217	194	322	318	175	173	120	152		
M. and H. D.	0	0	4	6	0	1	0	5		

[15]59 vehicles or 12.3% of total traffic. Total traffic, 481.

[16]29 vehicles or 6.6% of total traffic. Total traffic, 437.

ROUTE 3—*Continued.*

	1930 Daily Average	1929 Daily Average	1928 Daily Average	1927 Daily Average	1926 Daily Average	1925 Daily Average	1924 Daily Average	1923 Daily Average	1922 Daily Average	Per Cent Increase or Decrease Over 1929
Two miles south of Goldfield—										
Total vehicles	47	52	.....	.....	.....	.....	.....	.....	.....	—9.6
Trucks and busses	4	3								
Foreign cars	12	13								
Nevada cars	31	36								
M. and H. D.	0	0								
ROUTE 4										
North of Tonopah to Ely—										
Total vehicles[17]	193	222	166	176	82	123	99	85	.....	—13.1
Trucks and busses	28	34	21	21	6	12	7	12		
Foreign cars	17	19	18	19	9	16	13	16		
Nevada cars	148	169	126	136	67	93	78	57		
M. and H. D.	0	0	1	0	0	0	1	0		
Ely to Tonopah—										
Total vehicles	163	165	286	209	160	226	134	127	.....	—1.2
Trucks and busses	28	34	38	52	34	31	29	38		
Foreign cars	18	18	26	17	12	25	25	20		
Nevada cars	117	112	220	138	110	160	77	63		
M. and H. D.	0	1	2	2	4	9	3	6		
ROUTE 5										
Indian Springs north of Las Vegas—										
Total vehicles	25	35	25	24	13	.....	.....	.....	.....	—28.6
Trucks and busses	6	5	7	6	3					
Foreign cars	8	10	6	9	3					
Nevada cars	11	20	12	9	7					
M. and H. D.	0	0	0	0	0					
ROUTE 6										
Three miles west of Las Vegas—										
Total vehicles[18]	911	789	584	371	266	.....	.....	.....	.....	+15.5
Trucks and busses	89	42	59	47	25					
Foreign cars	328	340	236	128	93					
Nevada cars	492	406	288	194	146					
M. and H. D.	2	1	1	2	2					

Glendale—										
Total vehicles	486	326	326	222	.....	.....	.....	.....	.....	+ 49.1
Trucks and busses	65	34	38	21						
Foreign cars	325	242	173	153						
Nevada cars	94	47	113	46						
M. and H. D.	2	3	2	2						
				ROUTE 7						
Ely to Connors—										
Total vehicles	204	220	239	227	145	154	166	28	.....	— 7.3
Trucks and busses	47	54	36	39	23	17	28	12		
Foreign cars	19	32	33	24	18	41	30	11		
Nevada cars	138	133	170	163	103	95	103	5		
M. and H. D.	0	1	0	1	1	2	5	0		
Two miles south of Pioche—										
Total vehicles	178	176	127	142	129	.....	.....	.....	.....	+ 1.1
Trucks and busses	24	18	13	17	18					
Foreign cars	23	28	14	17	18					
Nevada cars	131	129	98	108	92					
M. and H. D.	0	1	2	0	1					
Ely to Pioche at Geyser—										
Total vehicles	46	44	28	20	.....	.....	.....	.....	.....	+ 4.5
Trucks and busses	7	5	3	5						
Foreign cars	10	9	10	3						
Nevada cars	29	30	15	12						
M. and H. D.	0	0	0	0						
				ROUTE 8						
Four miles north of Winnemucca—										
Total vehicles	152	166	126	148	.....	102	79	171	.....	— 8.4
Trucks and busses	25	24	17	19	.....	10	10	31		
Foreign cars	21	15	11	21	.....	16	9	19		
Nevada cars	105	125	98	108	.....	76	58	109		
M. and H. D.	1	2	0	0	.....	0	2	12		

[17]17 vehicles or 8.1% of total traffic. Total traffic, 210.

[18]305 vehicles or 25.1% of total traffic. Total traffic, 1216.

ROUTE 8-A

	1930 Daily Average	1929 Daily Average	1928 Daily Average	1927 Daily Average	1926 Daily Average	1925 Daily Average	1924 Daily Average	1923 Daily Average	1922 Daily Average	Per Cent Increase or Decrease Over 1929
Six miles east of Tonopah to Manhattan—										
Total vehicles	38	22	143	104	88	.....	.....	.....	.....	+ 72.7
Trucks and busses	7	0	12	8	7					
Foreign cars	8	0	24	12	6					
Nevada cars	23	22	106	83	75					
M. and H. D.	0	0	1	1	0					

ROUTE 9

Reno-Purdy—										
Total vehicles	635	605	585	471	605	565	533	.....	.....	+ 5.0
Trucks and busses	39	43	25	29	21	28	38			
Foreign cars	262	253	194	181	172	170	115			
Nevada cars	327	303	358	260	408	362	372			
M. and H. D.	7	6	8	1	4	5	8			

ROUTE 13

Two miles north of Wells—										
Total vehicles	76	72	51	68	.....	.....	.....	.....	.....	+ 5.6
Trucks and busses	4	3	2	2						
Foreign cars	51	44	37	31						
Nevada cars	21	25	11	31						
M. and H. D.	0	0	1	4						

ROUTE 24

Junction Routes One and Twenty-four to Ely—	
Total vehicles	67
Trucks and busses	6
Foreign cars	41
Nevada cars	20
M. and H. D.	0

EQUIPMENT DIVISION

HIGHWAY DEPARTMENT'S HEADQUARTERS SHOP AT RENO.

EQUIPMENT DIVISION

The equipment division is one of the most important parts of the State Highway Department's organization, for it is responsible and has control over the purchasing, distributing, storing, maintaining and accounting of all equipment and supplies used by the State for highway construction and maintenance.

Under the present system, which became effective during 1928, each piece of equipment has a set rental rate to cover repairs, replacements, depreciation, and administration expenses of the equipment division. Rentals are charged to each engineering division and are so arranged as to create a reserve fund for purchasing new equipment.

During this biennium the following units of equipment were purchased:

Automobiles	1	Studebaker.
	4	Chryslers.
	1	Oldsmobile.
	23	Fords.
	14	Chevrolets.
	1	Hupmobile.
	1	Reo.
	1	Durant.
Trucks	5	Fords.
	2	Chevrolets.
	8	¾-ton trucks.
	2	FWD 3½ ton.
Tractors	3	"60" caterpillars.
	6	"30" caterpillars.
	1	Monarch "50."
Graders	9	Motor graders.
	10	Pull graders.
Miscellaneous Equipment	1	Asphalt distributor.
	2	Asphalt heating kettles.
	10	Snowplows, push type.
	9	Planers and maintainers.
	3	Disc harrows.
	1	Concrete mixer.
	1	Scarifier, McMillan.
	1	Road broom.
	1	Traffic center line marker.
	1	Loader.

In addition to the new equipment purchased, the equipment division constructed five combination scarifier and road drags at an average cost of $316.

From salvaged trucks and miscellaneous equipment there were built: 1 oil distributor, 1 pile driver, 1 15-ton trailer, 1 water-tank trailer

INTERIOR OF HEADQUARTERS REPAIR SHOPS AT RENO.

SCENE IN CENTRAL EQUIPMENT YARD OF HIGHWAY DEPARTMENT AT RENO.

and 1 concrete mixer, and the following pieces of equipment were rebuilt:

2 Graders.	4 White 1½-ton trucks.
1 Maintainer.	2 Trailers.
6 Quad trucks.	10 G. M. C. trucks.
4 Pierce Arrow trucks.	3 10-ton Holt tractors.
4 FWD trucks.	1 5-ton Holt tractor.
6 Moreland trucks.	1 Heavy aviation truck.
2 Standard B trucks.	

Some of the equipment received from the War Department twelve years ago became useless during the biennium because of its several years' operation. This equipment was stripped of all useful parts, then the rest was sold for junk for which the department received $2,312.30.

The equipment division now operates from division repair shops in conjunction with the headquarters shop and general storage yard at Reno. These shops are located at Elko, East Ely, Tonopah and Las Vegas. Each shop is in direct charge of a competent mechanic who is responsible to the Division Engineer and Superintendent of Equipment for all shop activities and expenditures.

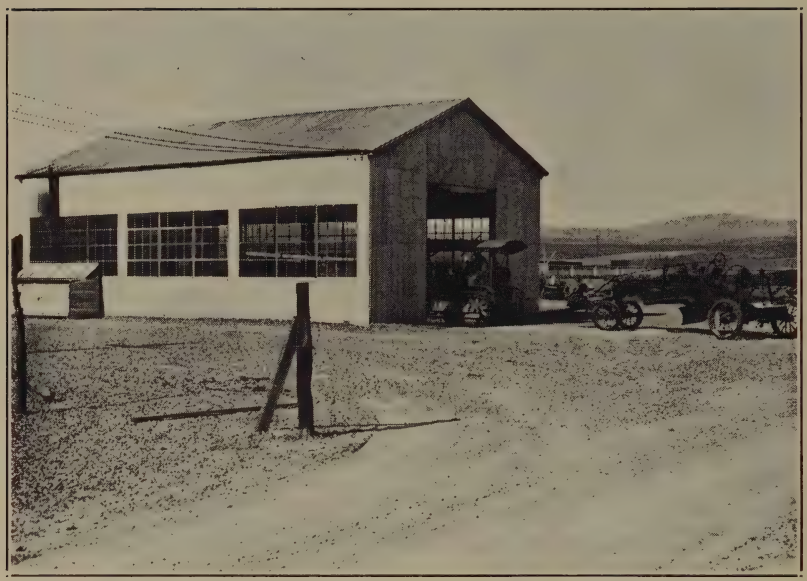
Previous to the installation of division shops, the Reno plant was used for housing and repairing all State-owned highway equipment. This arrangement proved to be unsatisfactory for economical operation in outlying districts, and gradually, as highway improvements were extended to all parts of the State, it became advisable to construct shops and storage yards in other localities.

During this biennium new buildings were constructed at Elko and Las Vegas to house the equipment repair shops. The old shop at Elko was merely a storage place where even minor repairs could only be made under extreme difficulties. To offset this condition a plot of ground was acquired and a steel framed corrugated iron covered building was erected and equipped for a repair shop. It is planned to construct storage sheds and erect a substantial fence around this property during the coming year.

In the early part of 1929 the Las Vegas repair shop was destroyed by fire caused by an oil explosion. A new building has been constructed on the old site and equipped with up-to-date machine shop facilities. A storage shed, blacksmith shop and gasoline pump have also been erected on this property and the entire plant is completely protected by a high barbed wire fence.

At East Ely the State owns a large well-constructed building which houses the division administrative offices as well as a modern repair shop. This property was acquired by the State several years ago, but clear title was not obtained until December, 1929. Recently a small tract of vacant land adjacent to the building was purchased. Upon this the Department expects ultimately to erect equipment storage sheds. Under the present arrangement the only place available for storage is in the repair shop, which is far from satisfactory.

The Tonopah repair shop was established in 1928 in an effort to reduce the excessive costs of repairs in this section. As there was no



EQUIPMENT SHOP AND YARD AT ELKO.

EQUIPMENT SHOP AND YARD AT EAST ELY.

adequate shop room available to lease, the Department purchased a good building and small tract of land in the town of Tonopah. The building was reconstructed into a modern shop, and storage sheds and yard were erected. This plant is modern throughout and is gradually being properly equipped to handle major repair work of all kinds.

The headquarters shop and storage yard in Reno are located on 3.65 acres of land near Coney Island. This shop does the general overhauling and rebuilding of all equipment belonging to the State Highway Department, and is one of the best equipped automotive machine shops in the State. The purchasing, storing and shipping of practically all repair parts and supplies used by the Department are administered from this plant by the Superintendent of Equipment. During 1929 the shop building was enlarged and a concrete floor constructed to replace the earth floor which was proving a handicap to efficiency. The interior and exterior of the machine shop were painted as well as the interior of the administrative offices. A new fence was constructed from salvaged woven wire highway guard fencing, and replaced an unsightly wooden fence which enclosed the front of the storage yard. These improvements have been beneficial to production and have added greatly to the appearance of the property.

LIST OF DEPARTMENT EQUIPMENT, NOVEMBER 30, 1930

Automobiles

2 Buicks. Purchased by Department.
19 Chevrolets. Purchased by Department.
4 Chryslers. Purchased by Department.
3 Dodges. Purchased by Department.
1 Durant. Purchased by Department.
27 Fords. Purchased by Department.
1 Hupmobile. Purchased by Department.
1 Oldsmobile. Purchased by Department.
1 Reo. Purchased by Department.
2 Studebakers. Purchased by Department.

Trucks

2 Chevrolets. Purchased by Department.
1 Fargo. Purchased by Department.
6 Fords. Purchased by Department.
24 F.W.D.'s. 2 purchased by Department. 22 received from Government.
16 G.M.C.'s. Received from Government.
4 Grahams. Purchased by Department.
10 Heavy Aviations. Received from Government.
1 Light Aviation. Received from Government.
9 Libertys. Received from Government.
7 Morelands. Received from Government.
13 Nash Quads. Received from Government.
12 Pierce-Arrows. Received from Government.
1 Reo. Purchased by Department.
1 Studebaker. Purchased by Department.
9 Whites. Received from Government.

Tractors

2 Cadillac 2½-ton. Received from Government.
7 "30" Caterpillars. Purchased by Department.
6 "60" Caterpillars. Purchased by Department.
2 Holts, 5-ton. Received from Government.
3 Holts, 10-ton. Received from Government.
1 "50" Monarch. Purchased by Department.

Trailers

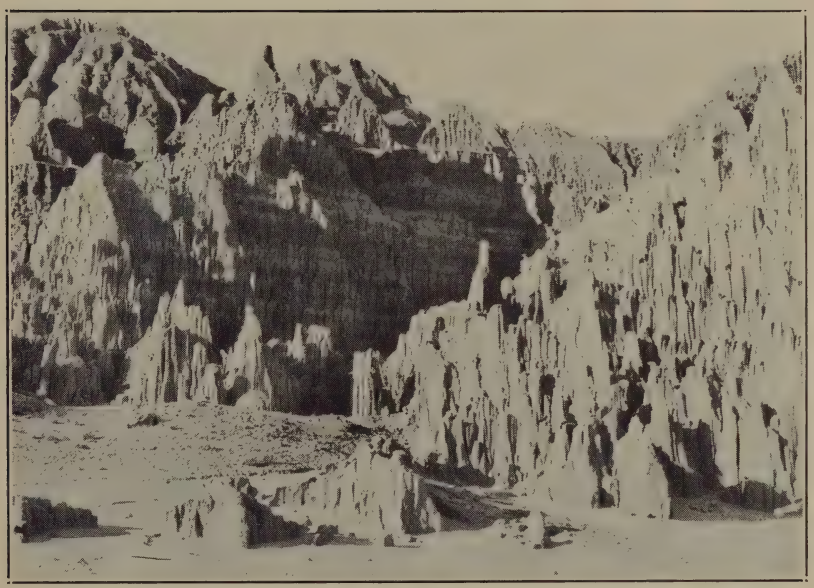
1 15-ton.
9 4-wheel.
5 4-wheel w-cookhouse.
8 2-wheel.

Miscellaneous

1 Bin.
1 Boiler.
1 Broom.
1 Compressor.
3 Conveyors.
1 Crane.
2 Crushers.
4 Oil distributors.
8 Drags.
6 Engines.
14 Graders, motor.
33 Graders, pull type.
8 Harrows, disc.
2 Kettles, asphalt.
1 Loader.
1 Machine, painting.
55 Maintainers.
1 Marker, traffic.
4 Mixers, concrete.
1 Mower.
1 Pile driver.
1 Paver.
15 Plows, snow, push.
3 Plows, snow, rotary.
2 Power plants.
10 Pumps, water.
2 Rollers.
1 Scarifier.
1 Winch.
1 Windlass.

EQUIPMENT SHOP AND YARD AT LAS VEGAS.

FINANCES AND ACCOUNTING



CATHEDRAL GULCH ONE MILE WEST OF STATE HIGHWAY ROUTE NO. 7 NEAR PANACA, LINCOLN COUNTY.

FINANCES AND ACCOUNTING

The accounting division keeps a complete and comprehensive record of all moneys received or collected, and accounts for all expenditures involved in conducting the Department's business. All accounting and auditing work is consolidated under a chief accountant who has direct supervision over an organization trained in the theory and practice of accounting. The complete procedure not only coordinates with the Department's engineering activities, but harmonizes with the standard procedure of the State and Federal Governments as well. In general there have been very few changes made in the accounting methods since the original installation; however, certain minor changes have been made to reconcile the various transactions between the Department and the Federal Government.

To correlate the work of the various divisions within the Department, each employee, having the responsibility of submitting bills, pay rolls, requisitions and other reports, is furnished with detailed and illustrated instructions relative to the accounting procedure, and is instructed to become thoroughly familiar with the requirements.

The accounting division depends largely upon each employee to submit the original transactions in proper form, as it is economically impossible to send an auditor into the field to check and verify each account. The utmost care is demanded of the men in the field in submitting accounts to headquarters for final audit and approval. The regular procedure in handling accounts is as follows:

All claims are presented through the division offices after being accounted for, classified, and approved by the division engineer. When they are received at headquarters they are again audited, and then approved by the State Highway Engineer. After his approval, the original copy of invoice is sent to the State Auditor, then to the State Board of Examiners, and, if approved, it then goes to the State Controller, who mails a warrant in payment.

Due to the fact that the Board of Examiners meets only on the 5th and 20th of each month to pass on bills, payment may seem delayed, particularly if a bill has to be sent back to the division office for explanation or correction. To avoid confusion and unnecessary delays the accounting department, as well as the division offices, makes a determined effort to exercise every precaution in checking and verifying all invoices and accounts.

A detailed distribution of accounts has been outlined to care for all operations of the Highway Department. Every claim bears a distribution which is posted by the bookkeeper. Each month a report is made showing all expenditures for the month; and each year a yearly report is made, giving the yearly expenditures.

The detailed distribution of accounts follows:

	Code	*Account*
I. Administrative Division—		
Executive Department	EX	Salary, State Highway Engineer.
		Directors' Travel Expense.
		Industrial Insurance.

	Code	*Account*
Auditing Department	AD	Salaries.
		Office Expense.
		Travel Expense.
		Auto Expense.
		Industrial Insurance.
General Offices	GOS	Salaries, General Engineering.
Salaries		Salaries, Office Clerical.
		Industrial Insurance.
General Offices	GOG	Stock Accounts.
General		Telephone and Telegraph.
		Light.
		Water.
		Postage.
		Freight and Express.
		Office Expense.
Field Operations	FO	Railway Transportation.
		Auto Expense.
		Travel Expense.
Police Department	PS	Auto Tax.
Salaries		
Travel Expense	PTE	Auto Tax.
Auto Expense	PAE	Auto Tax.
Office Expense	POE	Office Expense.
		Industrial Insurance.
		Gas Tax.
		Common Carrier.
County Highway Bond Redemption		Name of each County.
Special	SPEC	Road Mileage Survey.
		State Road Map.
		Traffic Surveys.
		Legislation.
		Traffic Audits.
		Advertising.
Miscellaneous	MISC	Bond Premiums.
		Biennial Report.
		Photography.
		General Expense.
		Insurance.
		Association Dues.
Building Expense	BE	Building Repairs.
		Building Supplies.
		Miscellaneous.
Drafting Department	DD	Salaries.
		Travel Expense.
		Auto Expense.
		Supplies.
		Industrial Insurance.
Blue Print Department	BP	Salaries.
		Supplies.
		Industrial Insurance.
Testing Department	TD	Salaries.
		Supplies.
		Auto Expense.
		Travel Expense.
		Industrial Insurance
		Research.
		Water Survey.
		Code 40—Gravel Wear Tests.

	Code	*Account*
Survey Department	SD	Salaries.
		Field Supplies.
		Travel Expense.
		Auto Expense.
		Industrial Insurance.
Maintenance	MAINT	Salaries.
		Industrial Insurance.
		Office Expense.
		Miscellaneous.
		Travel Expense.
		Auto Expense.

Division No. 1—

Salaries	A1S	General Engineering.
		Office Clerical.
		Industrial Insurance.
Office Expense	A1OE	Supplies.
		Telephone and Telegraph.
		Postage.
		Freight and Express.
		Office Rental.
Travel Expense	A1TE	Travel Expense.
		Auto Expense.

The same accounts appear for Divisions Nos. 2, 3, 4 and 5. The Division number in the "Code" after the letter "A" designates the Division against which the charge is made.

II. Equipment Division—

General Equip. Pur.	GEP	Equipment Division.
		Maintenance.
		General Office.
		Auditing.
		Survey.
		Drafting.
		Testing.
		Right of Way.
		Building.
		Division No. 1.
		Division No. 2.
		Division No. 3.
		Division No. 4.
		Division No. 5.
Reno Plant, Constr.	RPC	Machine Shop.
Reno Plant, Overhead	RPO	Supervision.
		Salaries.
		Telephone and Telegraph.
		Industrial Insurance.
		Ground Rental.
		Office Supplies.
		Fire Insurance.
Reno Plant, Stock Acc.	RP–STK	Gas and Distillate.
		Oil and Greases.
		Stock Parts.
		Stock Supplies.
		Stock Tires.
		Stockroom Operation.
Reno Plant, Gen. Yd.	RP–Yd	General Storage.
		General Yard.
Reno Plant, Mch. Shop	RP–MS	Shop Tools.
		Fuel, Light, Water.
		General Supplies.

	Code	*Account*
Reno Plant, Maint.	RP–Mt.	General Yard. Machine Shop. Office.
Reno Plant, Eq. Fund.	RP–EF.	Equipment Repairs. Depreciation. Miscellaneous.
*Las Vegas Shop.	LVS.	General Expense. Heat, Light and Water. Tools. Gas. Oil and Grease. Parts. Supplies.
III. Surveys, Plans and Estimates, Right of Way—		
County, Route, Section.	S–R.	Surveys and Reconnaissance.
	P–E.	Plans and Estimates.
	R–W.	Right of Way.
	B–D.	Bridge Design.
	M–S.	Material Surveys.
IV. General Maintenance—		
County, Route, Section.	G. A. No. S. A. No. C. M. A. No.	Cost of maintaining each county-route-section.
V. Accounts Receivable.	A–R.	Accounts collectible by Highway Department.
VI. Construction—		
Construction Authority.	C–A.	Work done by State forces.
10% Engineering.	70 and 79 with contract No.	Engineering on which Federal aid is received.
State Furnished Materials.	SFM.	Gravel. Cement. Sand, etc.
Progress Payments.	Estimate No.	Contract No.
Refund Payments.		Federal. County. City. Others.

In addition to keeping an accurate record of all moneys received and expended, the accounting division provides cost data and other statistics pertaining to construction and maintenance activities that are indispensable to administering the business of the Department. For instance over half of the Department's income from State sources is expended for maintaining the State Highway System. In conducting the maintenance work two types of authorizations are issued, namely, specific and general. The specific authorizations are granted to cover extraordinary maintenance or betterment work, such as bridge repairs, surface replacements, and all other work that adds to or betters the roadway and its facilities. General authorizations are issued to cover routine or ordinary maintenance work, such as dragging the roadway surface, cleaning culverts and ditches, removing slides, and all other work necessary to keep the roads in serviceable condition.

Each authorization is numbered and each expenditure is charged accordingly. And to insure a proper monthly balance between the

*Same accounts for Division Shops at Tonopah, Elko and East Ely.

funds authorized and the expenditures made, an exact record is kept of all pay rolls, invoices, and other accounts which are chargeable to the authorization under which the expenditure was made.

The engineering divisions, as well as headquarters, keep a ledger account of all maintenance transactions. This system keeps the division engineers and other administrative officers fully informed of the cost of maintaining each section of road on the State Highway System.

In conclusion it is a pleasure to state that all records are intact and available to permit a detailed audit.

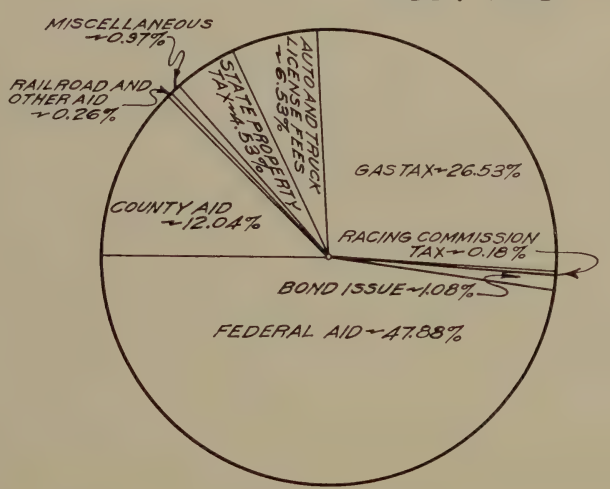
Financial Tables Nos. 22, 23 and 24 follow:

REVENUES AND EXPENDITURES

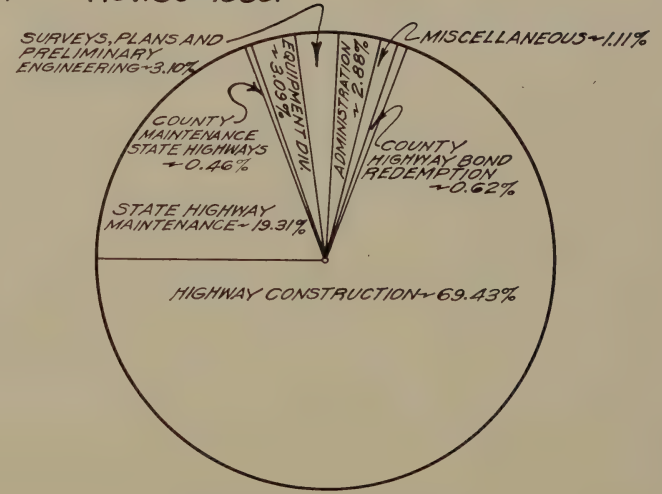
Graphic presentation of the relative amounts of revenue derived from different sources and the relative amounts expended for different purposes.

TWO YEAR PERIOD

Dec. 1-1928 to Nov. 30-1930.



REVENUES



EXPENDITURES

TABLE NO. 22

Statement of Receipts

Class of income	1917 to 1928	1929	1930	Total	Percentage
Legislative appropriation	$40,000.00			$40,000.00	0.17
State tax levy	1,267,775.13	$103,720.18	$106,201.86	1,477,697.17	6.35
Auto license fees	710,696.42	107,097.18	116,223.31	934,016.91	4.01
Gas tax	939,771.38	554,906.80	674,711.02	2,169,389.20	9.31
Racing Commission fees	129,352.18	8,303.35		137,655.53	0.59
Miscellaneous refunds	30,135.08	1,384.34	916.60	32,436.02	0.14
State Highway bonds	1,100,000.00	50,000.00		1,150,000.00	4.94
Federal construction refunds	9,969,614.52	1,098,609.18	1,120,686.76	12,188,910.46	52.34
County construction refunds	3,470,792.57	405,402.54	121,872.91	3,998,068.02	17.17
County refunds on state maintenance	59,000.00			59,000.00	0.25
County maintenance refunds	75,444.74	25,078.83	5,806.40	106,329.97	0.46
Lincoln Highway Association construction refunds	71,426.60			71,426.60	0.31
Utah-Nevada-California Association construction refunds	23,831.47			23,831.47	0.10
San Francisco Bay City construction refunds	25,000.00			25,000.00	0.11
City construction refunds	145,493.72	5,630.88	5,000.00	156,124.60	0.67
Railway crossing construction refunds	153,226.65	1,269.45		154,496.10	0.66
Accounts receivable	442,297.90	15,422.93	27,268.16	484,988.99	2.08
Common carrier			48,292.25	48,292.25	0.21
Certificate of title			31,270.50	31,270.50	0.13
Totals	$18,653,858.36	$2,376,825.66	$2,258,249.77	$23,288,933.79	100.00

TABLE NO. 23
Statement of Disbursements

Classification	1917 to 1928	1929	1930	Total	Percentage
Highway construction	$14,606,265.68	$1,565,342.50	$1,735,719.15	$17,907,327.33	76.45
Surveys, plans, and preliminary engineering	695,509.87	60,039.92	87,490.48	843,040.27	3.60
County maintenance	82,237.00	17,970.45	3,867.29	104,074.74	0.44
Equipment Division and Plants	410,973.35	60,450.51	86,548.23	557,972.09	2.38
Accounts receivable	426,590.33	23,053.30	29,512.19	479,155.82	2.05
Section 31 refunds	40,107.17			40,107.17	0.17
County highway bond redemption			29,721.65	29,721.65	0.13
General administration	761,300.02	70,064.75	66,969.78	898,334.55	3.84
Maintenance	1,645,435.69	418,065.08	500,031.86	2,563,532.63	10.94
Totals	$18,668,419.11	$2,214,986.51	$2,539,860.63	$23,423,266.25	100.00
Transfer to Revolving Fund Capital City Bank		$10,000.00		10,000.00	
Totals	$18,668,419.11	$2,224,986.51	$2,539,860.63	$23,433,266.25	
Receipts as shown by table				23,288,933.79	
Overdraft				$144,332.46	
Lists filed December 5, 1930, included in table			$158,507.31		
Overdraft			144,332.46		
Balance December 1, 1930			$14,174.85		
Reconcilement—					
Controller's balance December 1, 1930		$11,444.30			
Auto license fees for October and November included in table		4,057.93			
		$15,502.23			
Contractor's payment held up by Controller included in table		1,327.38			
		$14,174.85			

TABLE NO. 24

Estimated Bond Redemption

Year	Redemption of principal each year	Interest payments	Estimated license receipts	Estimated balance available
1920	$90,000.00	$654.15	$103,758.58	
1921	100,000.00	29,126.99	102,410.32	
1922	60,000.00	17,920.48	120,944.38	$29,405.01
1923		42,660.00	153,888.10	111,228.10
1924		25,640.00	181,969.85	156,329.85
1925	50,000.00	32,569.40	209,231.02	126,661.62
1926	100,000.00	31,750.00	209,919.71	78,169.21
1927	100,000.00	30,097.22	229,839.32	99,742.10
1928	100,000.00	28,814.59	249,110.62	120,296.03
1929	150,000.00	22,250.06	296,530.03	124,280.00
1930	150,000.00	16,000.00	295,000.00	129,000.00
1931	150,000.00	15,000.00	295,000.00	130,000.00
1932	100,000.00	8,600.00	295,000.00	186,400.00

Total bonds issued	$1,150,000
To be issued December, 1930	50,000
To be issued January, 1931	100,000
Total authorized by Legislature	$1,300,000

TYPOGRAPHICAL
UNION
LABEL
WASHOE